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Sintering—A Versatile Process

VIGNETTE

JOHN D. SULLIVAN

This month, for his contributions to the field of ceramics, John D. Sullivan is again being recognized by the American Ceramic Society. The recognition comes in the form of a lifetime honorary membership—the sixteenth American in the entire history of the Society. This most recent affirmation of his technical accomplishments reflects but one facet of Sully's interests. As his career attests, he has lent his talents to the advancement of a number of disciplines.

In ceramics, he had a key role in the earliest Battelle studies and has been associated with: inquiries into the surface chemistry of clays; development of refractories; examination of the nature of expanded aggregates; exploration of methods for enameling copper; and other subjects. Sully joined the Institute staff in 1931. One of his earliest challenges was to guide Battelle's then just-established analytical chemistry laboratory. In addition to its service function, that laboratory continues a tradition of research in analytical chemistry first inaugurated by Sully. He was associated also with the earliest Institute studies on mineral and metal economics and extractive metallurgy. Throughout all of this he has sought fundamental—rather than empirical—approaches to the solution of research problems.

Beginning with World War II, Sully's talents have been drawn upon by the National Academy of Sciences—National Research Council. He served as chairman of the Processes Research Division of the War Metallurgy Committee and on other of the Committee's groups and panels. He undertook, also, the setting up of numerous research programs for the War Production Board. For these important wartime activities he received special recognition from the War and Navy Departments. Since then he has served in other capacities, including current work with the Academy's Office of Critical Tables and Manganese Ore Panel.

Technical Director at Battelle since 1945, Sully is author of more than 100 published articles and papers and his name appears on 19 patents.

Sully has long contributed to the activities of technical societies. He is a former president of the American Ceramic Society and in 1957 was recipient of its first Presidential Award for having served the Society "with wisdom, with patience, with energy". Currently a member of the Board of Trustees of the Metallurgical Society of the American Institute of Mining, Metallurgical, and Petroleum Engineers, he is active on a number of its committees. He is also active in the work of the American Society for Testing Materials, which in 1952 bestowed upon him its Award of Merit. A Fellow of the Society of Glass Technology, he holds membership in other technical organizations both foreign and American.

Before his association with Battelle, Sully served at experiment stations of the U. S. Bureau of Mines. At the Southwest Station he carried on pioneering research on the leaching of copper ores. Earlier he had received his B.S. degree in chemistry and M.S. degree in metallurgy and chemistry from the University of Washington.

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What Price Isolationism in Science?

Some years ago, this country learned that a steep price had to be paid for our flirtation with isolationism. We paid the price, and most of us vowed "never again".

It appears, however, that isolationism can rear its head in varied forms. Now, a strong movement is afoot which could isolate scientists into separate camps. There would be "pure" scientists, or those engaged in fundamental research, and "applied" scientists, or those pursuing work having more immediate utilitarian values. This schism would come about principally through the setting up of so-called "pure" research programs and the establishment of institutions dedicated solely to "basic" research.

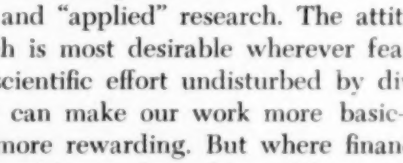
One wonders if there is any real value to separating fundamental science from applied science—even in casual talk. Do we really mean what we say when we drag out the old pure-versus-applied science arguments? Aren't we really engaging in another how-many-angels-can-stand-on-the-point-of-a-needle exercise while the Soviets push ahead with singleness of purpose? Might we not have to pay a steep price for splitting scientists into arbitrary, hostile groups?

Everyone of good faith has one idea in mind when he brings up this subject. He means that what we need in this country is a more basic approach in *all* our research. Everyone agrees that to make the fastest progress with the minimum effort, we need better scientific theories, better understanding of underlying principles, new concepts, new intellectual tools with which to work. The question is: Why don't we say what we mean and quit this futile, isolating, misleading debate?

Better theory, understanding, concepts, and tools do not come from such debate. Neither will we get them by disparaging programs now in progress or those carried out in the past. Work, study, and cohesion will produce what we as a nation want. Can we not defeat our unity of purpose by playing a game in semantics?

The traffic in inspiration, ideas, and techniques moves in both directions between so-called "basic" and "applied" research. The attitude that recognizes that a basic approach is most desirable wherever feasible is all we need to go ahead in our scientific effort undisturbed by diverting forces. Certainly, in many cases, we can make our work more basic—more probing—and, thus, very probably, more rewarding. But where financial support makes a basic approach infeasible, need we be unduly concerned if empirical methods are resorted to in the achievement of a worthy end?

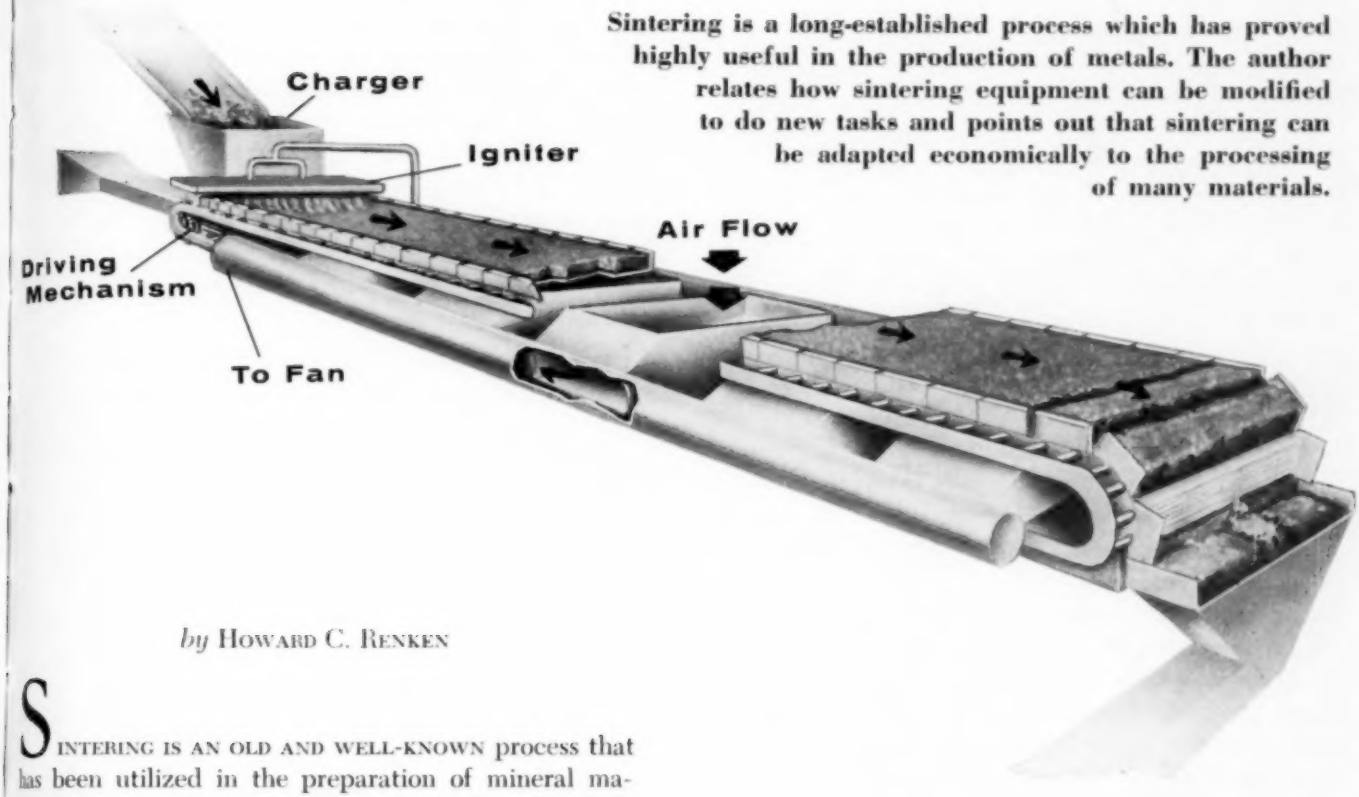
It would seem appropriate to make concessions to the ideal approach rather than to flirt with isolationism and dissension in scientific philosophy.



B. D. Thomas,
President, Battelle Memorial Institute.

Sintering -- A Versatile Process

Sintering is a long-established process which has proved highly useful in the production of metals. The author relates how sintering equipment can be modified to do new tasks and points out that sintering can be adapted economically to the processing of many materials.



by HOWARD C. RENKEN

SINTERING IS AN OLD AND WELL-KNOWN process that has been utilized in the preparation of mineral materials for many years. In 1908, an important development took place that made the process much more useful and versatile—Arthur S. Dwight and Richard L. Lloyd invented the method for continuous sintering. Since that date, sintering has been applied in many industries and to many materials. It is used, for example, to prepare bauxite, copper, iron, lead, manganese, nickel, phosphate, zinc, and other ores for subsequent treatment in blast furnaces or by other methods. The process is used also for making lightweight aggregate and for burning clinker for production of Portland cement.

The sintering process was developed because of the difficulties that arise in the handling and treatment of fine ores and concentrates. Such fine materials create dusting problems when handled and are also difficult to process because they obstruct the passing of gases. Sintering overcomes these difficulties by causing the fine particles of ores and other materials to bond together, or agglomerate, into pieces which are strong enough to hold their shapes when stored or when smelted in furnaces. There are several mechanisms, including the formation and intergrowth of crystals, formation of compounds, and incipient fusion, that cause the charge particles to agglomerate in sintering.

1. *Typical sintering equipment. Material to be treated is placed on the rectangular pallets by the charger (left) and then the surface is set alight by the igniter. As the pallets move along, air is drawn through the burning material by successive wind boxes and propagate combustion to the grates. The process is so timed that when the pallets have moved to the end of the track, the combustion has reached the grate and the sinter is ready to be emptied from the pallets.*

This article presents a brief description of the sintering process as it is now employed, along with a discussion of modifications that have been developed and potential uses of the process in various industries.

THE MECHANISM OF SINTERING

The essential elements of the most common process and equipment for continuous sintering are depicted in Figure 1 above. This drawing shows a number of individual containers, termed pallets, for receiving and conveying the material to be treated. Pallets are simply rectangular troughs with walls on two sides and grates to support the charge. The pallets successively pass under equipment which deposits

and levels a bed of charge material, under a burner which ignites the upper surface of the charge, and thence over chambers called wind boxes which are connected to the exhaust side of a fan to draw air through the charge on the pallets. The rate of travel of the pallets is regulated so that they will arrive at the end of the wind-box section when combustion reaches the grate bars.

In this manner, mixtures of ores and concentrates containing fuel are ignited, and the initial combustion is propagated downward to the underlying grates. The heat developed by the combustion of the fuel in the layer of charge produces the porous agglomerate called sinter. While the sintering is taking place, other useful purposes, such as the decomposition of carbonates or sulfates and the elimination of sulfur, usually referred to as roasting, are performed.

Sintering is a remarkable process which has been likened to burning fuel containing over 95 per cent of ash on a stoker grate. This simile is explained by the fact that as little as three per cent of coke breeze mixed with iron oxide, for example, will burn and generate temperatures of about 2500 F during sintering. In properly conducted sintering operations, the high temperature does not spread throughout the layer of charge, which may be about 12 inches deep. Instead, combustion is localized in a band perhaps an inch deep which advances at the rate of about one inch per minute. The oncoming air cools the product above the combustion zone; the heat is transferred to the raw charge immediately below the hot zone so efficiently that the average temperature of the gaseous product drawn through the grate will be about 350 F. A graphic portrayal of the time and temperature relationship at one point in a bed being sintered is shown in Figure 2.

The behavior of sulfides in sintering is interesting because, in many processes, sulfides constitute the fuel for the operation. In general, from five to seven per cent of sulfide sulfur will furnish the heat to sinter usual mixtures of metallurgical materials. Incidentally, none of the processes for roasting to eliminate sulfur, except sintering, can be sustained with such small amounts of sulfides. In sintering ores, concentrates, or cinder from pyrite burners, a charge containing from five to seven per cent of sulfide sulfur, depending on the particular material, can be sintered without adding carbonaceous fuel. Consequently, it is possible to blend raw materials containing too much sulfur with returned sinter to obtain a mixture with the proper quantity of sulfur for autogenous sintering. It also is possible to produce iron sinter containing less than 0.05 per cent sulfur from such mixtures. If the raw materials contain less than the required amount of sulfur, five to seven per cent, it is, of course, necessary to augment this fuel with coke breeze or the like.

In the preparation of sinter for zinc retort furnaces, it is common practice to return very large portions of crushed sinter to dilute the sulfur in the raw concentrates. For example, if a zinc concentrate contains 30 per cent of sulfur and a sintering machine charge with six per cent of sulfur is desired, about four parts of return sinter must be mixed with one part of the concentrate. This practice may be viewed as five passes of sintering to obtain a product containing less than 0.5 per cent of sulfur.

Phenomenal Growth of Sintering

The growth of the sintering industry as well as that of individual plants and individual sintering machines has been remarkable in the fifty years since the first straight line machine was put into operation in 1908. This first machine had a capacity of about 25 tons per day of nonferrous sinter. It was only 2½ feet wide by 10 feet in effective length. About three years elapsed before the process was applied in 1911 to sinter ferrous materials. The basic machine and process was widely adopted with the result that by about 1920 a number of lead smelters had from four to twelve sintering machines operating. These machines were built to a standard pattern with effective areas measuring 3½ by 22 feet. A number of improvements in materials handling and mechanical features were introduced and the technique of double sintering of lead charges was evolved.

During the 1920's it was found advantageous to

The author writes from a background of 30 years of experience in ferrous and nonferrous sintering. During more than 15 years at Battelle, he has investigated problems associated with the sintering, nodulizing, briquetting, and pelletizing of ores and other materials and has participated in studies of other problems in the extractive metallurgy field. He played a leading role in the development of an unusual pyrometallurgical process for producing sulfur from pyrite which utilizes sintering equipment. One of Renken's responsibilities has been the analysis and evaluation of proposed extractive processes. Earlier in his career he supervised sintering at lead and zinc smelters and carried on research and development on unusual processes in that area.

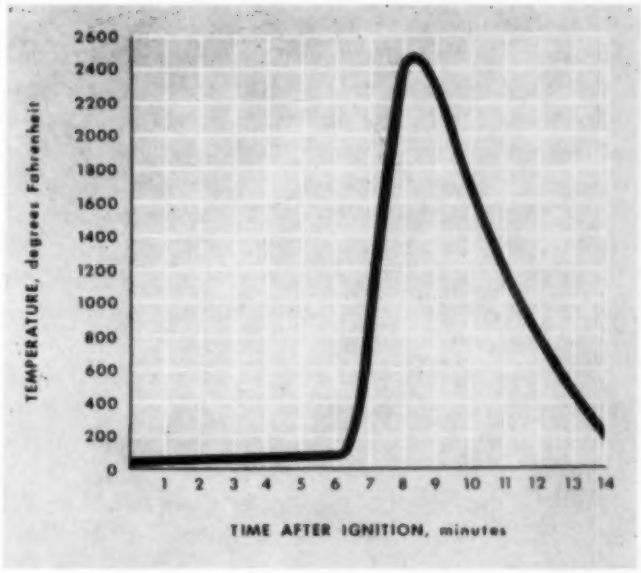
sinter instead of simply roast zinc concentrates in preparation for retort processing, and the iron and steel industry continued to install sintering machines. These were somewhat standardized at six feet in width and finally reached 168 feet in length. In 1940, a lead smelter replaced 13 small machines with two units which were 10 feet wide by 50 feet long. Then in 1950 a zinc smelter installed the largest sintering machine in existence at that time, 12 feet wide by 168 feet long. This size was surpassed only during the past year by the erection of a single machine to produce 7000 tons of iron sinter per day on a machine with effective dimensions of 12 feet by 200 feet. As a consequence of these developments, most of the world's supply of lead is smelted from sintered ores and concentrates. Practically all of the zinc produced by distillation comes from sintered charges. Moreover, the capacity for the production of iron sinter in the United States soon will exceed 60 million tons annually.

It is beyond the scope of the present discusison to enumerate the many advances and improvements that have been made in 50 years of development of sintering. It suffices to say that modern sintering plants capable of handling thousands of tons of materials daily are marvels of engineering. The sintering machines proper constitute only small parts of the integrated plants which include facilities for storage, crushing, proportioning, mixing, sinter cooling, gas cleaning, and process control.

Recent Innovations in Sintering Practices

The discussion above has been devoted to the applications of sintering machines for simply roasting and agglomerating raw materials. A number of more complex procedures or departures from conventional sintering have been reported recently. Some of these methods are described briefly in the following paragraphs.

A great deal of attention has been devoted to the pretreatment of mixtures for sintering to obtain charges which will present maximum permeability to the flow of gases. This is important because the rate of sintering depends on the rate at which air can be passed through the bed of charge on the sintering machine grates. Over the years, a number of mechanical means have been proposed or used to deposit and to "fluff" sintering machine charges with the purpose of improving their permeability. Most of these means have not been adopted widely. The idea for pelletizing or balling the charge has been practiced to a limited extent for many years. The past decade has witnessed notable advances in the use of pelletized charges for treatment on sintering machines.



2. *Heating cycle in a sintering bed. The data were registered by a thermocouple placed midway in a sintering bed of iron ore and coke breeze 12 inches deep.*

Recently, two lead smelters have reported favorable results from the use of pelletizing drums in the preparation of their charges. At one of the smelters the quality of the damp pellets is sufficient to enable them to be stored in large bins. A third lead smelter developed a process for sintering lead concentrates containing 40 to 70 per cent of lead. Sintering or roasting concentrates with these contents of lead always has posed a problem because of the tendency of high lead charges to smelt or to become sticky. This difficutly is overcome in the case cited by the use of three pelletizers in series which produce pellets comprised of concentric layers of lead flue dust, limestone, and lead concentrates on cores of returned sinter. Very large increases in production have been reported when pelletizing disks have replaced pug-mills for mixing iron ore charges for sintering machines.

Three distinct applications of sintering machines to heat-harden balls of iron ore concentrates and leached calcine have ben introduced. In two of these cases the balls are coated with coal for subsequent burning, while in the other case oil is burned in a muffle placed over the sintering machine. Combinations of upward blowing in sections of the machines and downdraft in other sections are employed in these processes, to dry, preheat, burn, and cool the balled charges.

Updraft sintering, that is, blowing air upward through the charges on sintering machines, also has been adopted in lead smelters. Several advantages have been claimed for this reversal of procedure. No troublesome lead is deposited on the grates and in the wind boxes and the concentration of sulfur dioxide in the gas is higher in the updraft operation.

A method developed at Battelle employs a sintering machine to perform three operations in a single step—agglomeration and partial reduction of the ore and carbonization of the fuel for subsequent smelting. A unique method for first calcining and then sintering iron ore on a single machine is scheduled to be in production in Europe. This will involve the use of two layers of charge materials. The lower layer will consist of a carbonate ore mixed with just sufficient fuel to decompose the carbonate but not sufficient to agglomerate the particles appreciably. The upper layer will be comprised of recycled calcine and enough fuel to make acceptable sinter. The sinter and calcine discharged from the machine will be separated by screening.

Battelle developed a process to produce elemental sulfur, iron sinter, and sulfur dioxide from pyrite flotation concentrate. In this process, a charge of the pelletized pyrite is placed on a sintering machine which is hooded to control the air supply; and the pyrite is ignited in the usual manner. As the combustion advances through the bed of pellets, the pyrite immediately below the hot zone is decomposed into iron monosulfide and sulfur. The sulfur vapor is borne in the gas and is subsequently condensed and collected. The iron monosulfide provides the fuel for the advancing combustion, and the oxygen is consumed so completely in the combustion zone that essentially none of the elemental sulfur liberated from the underlying pyrite is burned. Recirculated gas depleted in oxygen is mixed with the air used for combustion. This diluent, or coolant, is necessary because the iron monosulfide would smelt if it were burned in air.

Inherent Advantages of Sintering

The foregoing examples illustrate that there are many possibilities for modifying basic sintering machines and operations to perform a number of functions besides simple roasting and agglomeration. Some of the factors which make sintering an attractive process are discussed in the following paragraph.

Sintering machines are well developed rugged mechanisms which can be obtained in a variety of sizes and can be modified for special purposes. Extremely fine concentrates or relatively coarse products can be processed. Various techniques have been developed to control the distribution of the charge in placing a bed of material on a machine. A minimum of dust is produced because the charge is dampened initially and is not agitated in the process. The charge is conveyed *en masse* in a positive manner. This is an advantage over roasters, rotary kilns, and shaft furnaces for the treatment of materials which tend to become sticky and to form clinkers and accretions. Heat transfer is direct and, consequently, the process is thermally efficient.

Research Still Needed

The economics of the process has received proper attention only recently. There are a number of interrelated factors in the construction and operation of sintering machines that can be varied to influence the economics of an operation. Basically the problem is to initiate and propagate combustion through a bed of charge material in the most economical manner with due regard to the quality of the product. The quantity of material discharged by a sintering machine with a given grate area is not necessarily a criterion of an effective sintering operation.

A complex relationship exists between the construction, operation, and maintenance costs of such a process. These costs are related to the dimensions and area of the effective grate used for sintering, and they are influenced by the unit costs for labor, ignition and charge fuel, and power, all of which may vary from place to place. The quantities of some of these items in turn are related to the permeability of the charge which is a function of the methods used to prepare and to deposit it on the sintering machine in some variable depth. Obviously each situation should be evaluated in light of its own particular circumstances to determine the most economical set of conditions.

In spite of the many accomplishments in the field of sintering, a great deal of research and development remains to be done. More work is needed to develop methods for preparing sintering machine charges that will present maximum permeability to the flow of gases. Investigations in this area should embrace blending, mixing, pelletizing, and methods for bedding the prepared charge on the grates to obtain the best pattern of distribution of particle sizes.

Mechanism of Combustion

The mechanism of combustion in sinter beds should be investigated further. It is very desirable to have a narrow band of combustion advance through a bed. The conditions that will provide this type of combustion should be better defined. It also might be useful to determine why the rate of travel of the flame increases as sintering progresses in a given bed and why the rate is slower in shallow than in deep beds.

Research also is needed to improve the quality of sinter in general and to produce agglomerates with special characteristics, for example, fluxed sinter for blast furnace charging or dense material more suitable for open hearth furnace consumption. Salt has been

used to expel chlorides of undesirable elements in sintering nonferrous materials. This method and similar ones might find use in other industries. Fortunately, most of the research required on sintering fundamentals and special treatments can be conducted by small-scale experiments on batch bases.

Mechanical Improvements

Much room remains for mechanical improvements and innovations of the equipment used in sintering. It has been stated already that further research and development should be devoted to the preparation and layering of sintering machine charges. It is a fact, however, that some of the equipment and techniques that have been proved advantageous at some plants have not been adopted widely through failure to realize the advantages. Continuous sintering machines are infamous for the large quantities of air that leak into their suction system. None of the devices and methods that have been employed to seal the traveling pallets to the stationary wind boxes are very effective. The development of more efficient seals would be a promising subject for research.

Making sintering machines wider with respect to their lengths is an obvious method to reduce wind-box leakage when the conventional sealing methods are used. This would reduce the length of the contacts that require sealing. The minimum length would be presented if the widths of the effective grate area were made equal to the length. Such dimensions would be impractical in the case of very large grate areas. It appears, however, that machines erected recently with wind-box areas 28 times as long as they are wide are poorly proportioned. There are other apparent advantages relative to the costs of construction and to the costs of maintenance and operation of sintering machines which favor greater widths. In view of these advantages, it is believed that future large-scale sintering machines will be wider than the present maximum of 12 feet.

Updraft Sintering

There are also several advantages in updraft sintering in comparison with the more conventional downdraft method. Metallurgical and operational advantages have been demonstrated for the updraft procedure in some instances, but the relationship of this method of operation to the construction of sintering machines has not been emphasized. Because the heat evolved in updraft sintering is carried away from, instead of toward, the grates and pallets of a sintering machine, less rigorous conditions are imposed on the machine. Hence, it appears that it would be feasible to employ lighter, perhaps trussed, pallets instead of the massive ones presently used. Furthermore, it would be simpler to convey pallets on supports within updraft wind boxes because the supports would not be subjected to dusty atmospheres at high temperatures. The ability to use lighter pallets or to minimize the span by supporting pallets within the wind boxes would make wider sintering machines more feasible. A simpler and more efficient method could be developed for igniting charges for updraft sintering.

The basic process and equipment for continuous sintering with the various techniques developed for special purposes have a great deal to offer industry besides means for roasting and agglomeration. Know-how, which is being developed throughout the world, is adding greatly to the versatility of the process. Research, guided by knowledge of the applications that have already been made, could well aid in adapting sintering to processes requiring oxidation, reduction, volatilization, decomposition, and distillation.

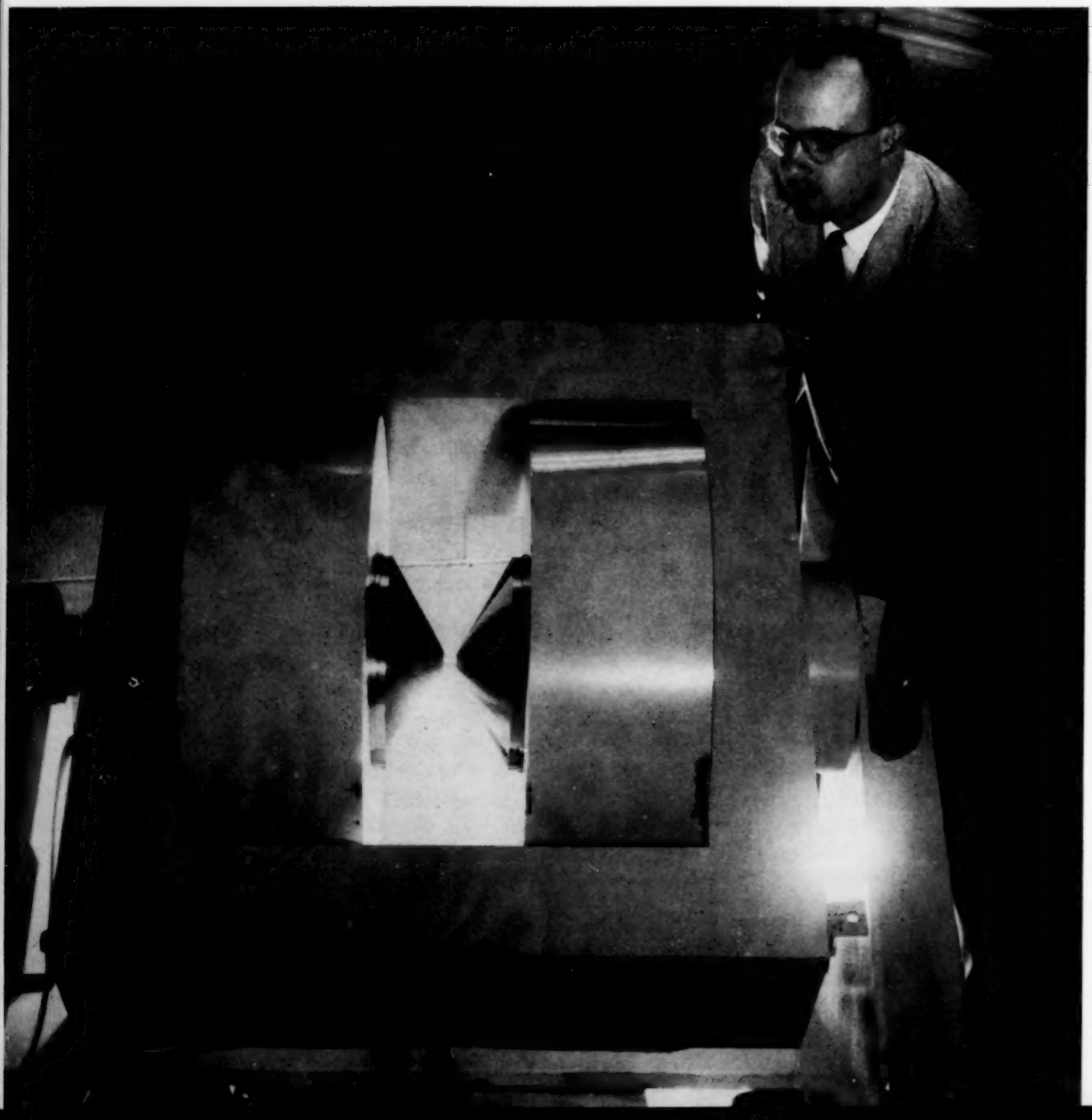
CERTAINTY NEVER ARRIVES

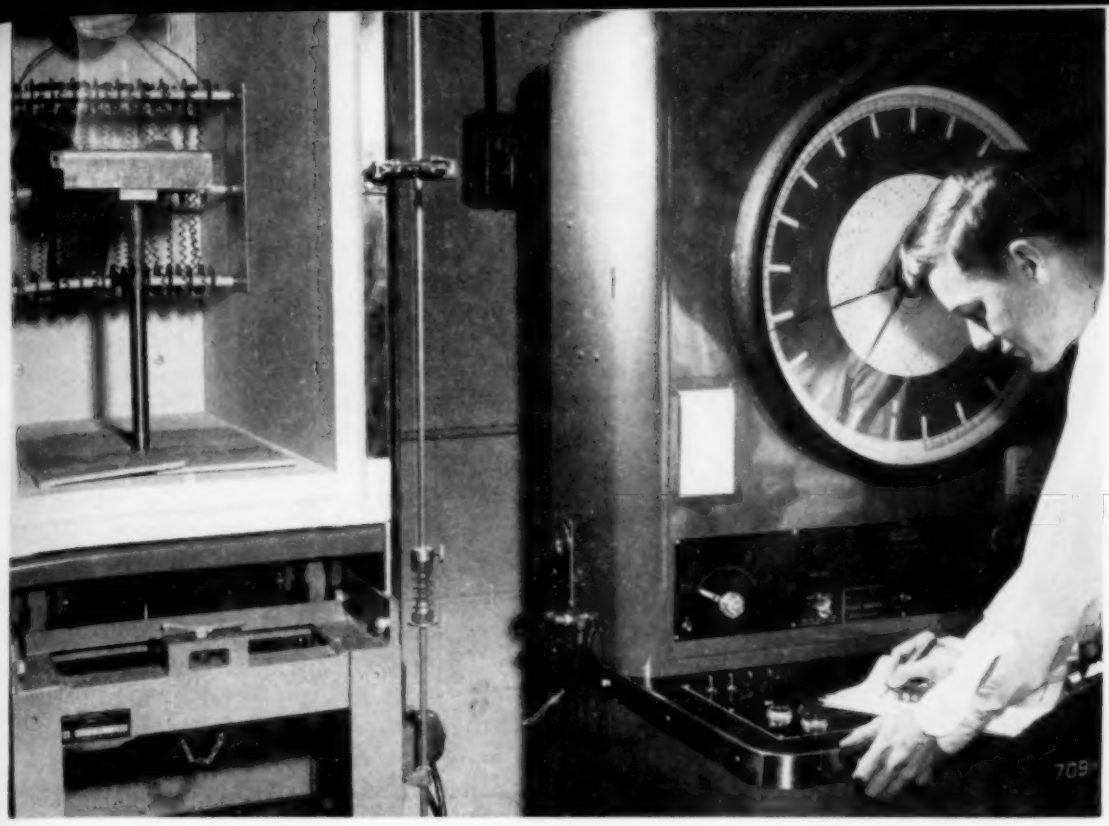
". . . an experiment . . . amounts in effect to asking a question of nature. This question can never be—'Is hypothesis *A* true?' but 'Is hypothesis *A* tenable? Nature may answer our question by shewing us as phenomenon which is inconsistent with our hypothesis or by shewing us a phenomenon which is not inconsistent with our hypothesis. She can never shew us a phenomenon which proves it; one phenomenon is enough to disprove a hypothesis, but a million million do not suffice to prove it. For this reason, the scientist can never claim to know anything for certain, except direct facts of observation. Beyond this, he can only proceed by building up hypotheses, each of which covers more phenomena than its predecessor, but each of which may have to give place to another hypothesis in due course. Strictly speaking, the time for replacing a hypothesis by a claim to certainty never arrives."

James Jeans *in New Background of Science*

MAGNET FOR SEMICONDUCTOR STUDY

This 7000-pound magnet is an important aid to scientists in the study of basic transport properties in semiconductors and of the effect of a strong magnetic field on the band structures of the materials. These effects are characterized by increase of the electrical resistance of the materials as much as 500 times in a magnetic field. The gap in the magnet can be adjusted to permit evaluation of specimens cooled by liquid helium, a condition which also greatly affects the electrical properties of semiconductors. Harvey L. Goering, chief of Battelle's Physical Chemistry Division, states that Battelle scientists, using such cooled specimens, have been able to measure impurities present in materials in amounts as small as one part in 100 billion. Robert T. Bate, who is associated in studies using magnetic fields, adjusts the magnet, which operates at 2400 volts and produces a magnetic field strength of about 30,000 Gauss.





Stretching plastic filaments and films improves their strength and other propetries. Factors that affect the properties include temperature at time of stretching, strain, and strain rate. With this equipment, it is possible for the technologist to vary the conditions and thus determine which provide the optimum properties.

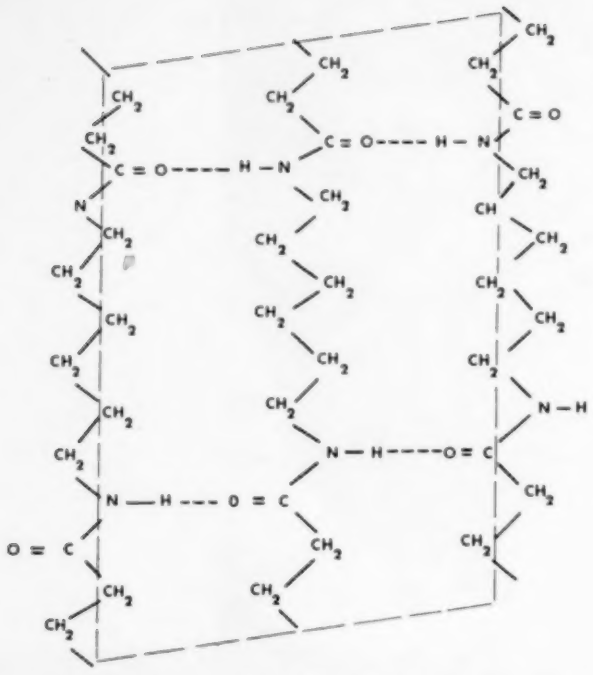
Crystalline Polymers Promise Improved Plastics

The author believes that only a fraction of the potential of plastics has been tapped and that new methods of processing will greatly extend their possible uses. However, he sees the ultimate polymers as those with molecules of identical size and composition that will permit tailoring of plastics for specific uses.

by Charles W. Hamilton

As new and improved polymers are developed, plastics become more acceptable as true materials of construction. In the past, plastics frequently have been chosen for a particular application only after conventional materials such as wood, concrete, or metals have been found to be inadequate—one might say, a choice made in desperation. The principal reason for this unusual situation is a lack of adequate specifications, engineering data, and, even more important, basic knowledge of the behavior of plastics. It is reasonable to state that only a fraction of the potential usefulness of the plastics already available has been tapped and that the development of new methods of processing these materials will extend their fields of application many times.

This statement applies most directly to the newer thermoplastic polymers such as nylon, high-density polyethylene, and polypropylene. They differ from other plastics in that they have a more ordered molecular structure, which encourages the formation of a



2. *This schematic diagram of nylon illustrates the close relationship between regularity of molecular structure and crystallinity. The dotted lines indicate hydrogen bonding, one of the attractive forces leading to crystallization.*

crystalline phase and profoundly affects their properties. In general, predominantly amorphous or uncrystallized, polymers are characterized by a broad softening temperature range, brittleness at low temperatures, and moderate tensile properties; these contrast with the sharp melting point, good impact resistance at low temperature, and relatively high-tensile strength of crystalline plastics. We also find that the behavior of a crystalline polymer is dependent upon its previous thermal and physical history. Therefore, it is usually possible to obtain further improvements in performance by such operations as quenching, annealing, stretching, cold-working, or biaxial orientation.

Factors Affecting Properties of Crystalline Polymers

In order to understand these crystallizable polymers more fully, let us examine the factors that contribute to their unusual properties. In the first place, polymer molecules are unique in that they consist of long chains of covalently-linked atoms which are relatively free to rotate and assume various configurations. Under some conditions, the primary structure is that of an entangled mass usually referred to as the amorphous phase. However, if the molecules have some regular structure, there are thermodynamic conditions that will cause an alignment of segments of the molecules resulting in the formation of a crystalline phase. Observations of these regularly ordered polymers prove that none of them are completely crystalline; rather they contain both phases, with the crystal phase varying from 10 to 90 per cent of the total.

In addition to establishing the concept of the simultaneous presence of both crystalline and amorphous phases in the bulk polymer, research has shown, secondly, that the crystal sizes are less than the length of the molecules, indicating that one molecule may pass from one phase to another. As an illustration of this type of structure, one might imagine a bundle of uncooked spaghetti held in the hand. If one end of this bundle were placed in boiling water and thoroughly cooked, the ends of the spaghetti would soften and become entangled, while the uncooked ends would remain in their parallel relationship to each other. If each length of spaghetti were imagined to be a molecule of plastic, it can be seen that a single molecule can simultaneously occupy an amorphous or entangled area and a crystalline or spacially oriented area.

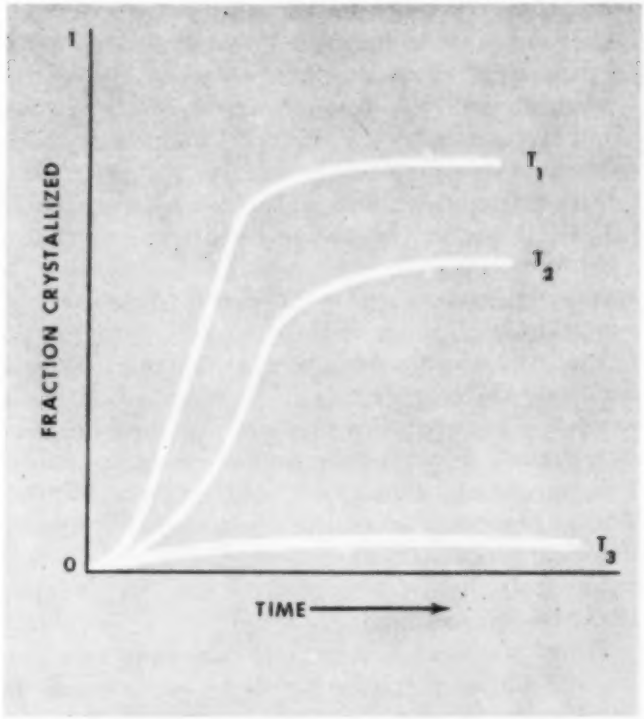
In the molten condition, the bulk polymer is a viscous mass, since the molecules are long and coiled every which way among each other. When solidified, scientists have shown that a fraction of the polymer consists of crystals formed by the orderly array of the molecules in a lattice network. A very close relation between regularity of molecular structure and crystallizability is evident when one studies the schematic diagram of nylon as shown in Figure 2. The dotted lines indicate hydrogen bonding, which is one of the types of attractive forces leading to crystallization.

A third concept of importance is that the thermodynamic forces contributing to the transformation

Charles Hamilton's research interests have been primarily in the plastics field. He has probed the structures of the polyolefins and the chemical nature of adhesives. In work with nylon, he has explored its possible uses for jacketing wires and cables and for other industrial applications. Other studies have included the use of resins for electrical insulation and for encapsulating electrical components. A current interest is the application of plastics to packaging. Prior to joining Battelle, Hamilton was associated with the synthesis of organic chlorine derivatives at Columbia-Southern Chemical Corporation. He is author of six articles and papers on plastics research.

from the amorphous to the solid state containing a crystalline fraction must overcome the kinetic factors of disentanglement and alignment in the viscous mass. If the molten polymer is cooled rapidly, it is possible that the amorphous entangled state may be frozen in place. If the cooling is slower, there is a better chance for crystallization to take place. Thus, a crystallizable plastic might exist in several states each containing different amounts of amorphous matter depending on previous thermal history.

Finally, there is evidence of a structural unit in these polymers of larger size than the crystal unit itself. In other words, there are aggregates of crystals than can be formed under certain conditions. These aggregates are termed "spherulites" and have been found to influence the performance characteristics of the bulk polymer also. Sometimes these spherulites become quite large and can be viewed under the microscope using polarized light. They usually appear spherical in shape, therefore the name. There is little known about the arrangement of the crystalline and amorphous areas in the spherulites or why they assume this shape. Recent work indicates that cracks, which occur when some plastics are stressed in the presence of certain chemical agents, follow the borders of these larger units.



3. *The effect of time and temperature on the growth of the crystalline fraction of a polymer. The figure represents the cooling of a polymer from the melt to three levels of temperature. The highest temperature (T_1) permits growth of the greatest amount of crystallinity in the shortest time.*

Process Variables Affecting Crystallization

An excellent example of crystalline polymers is nylon, a high-molecular-weight polyamide, which was commercialized about twenty years ago. The discovery that an extruded monofilament of this polymer could be stretched under special conditions to give a high-strength fiber, advanced the development of the synthetic textile field tremendously. Since that time, a vast amount of study has led to an increased knowledge about crystalline polymers and how they may be processed to take advantage of their unusual characteristics. The most significant advances have been made in studying the effects of thermal treatment and physical orientation on these plastics, and it has become evident that these are the main process variables affecting crystallization.

Annealing

The principal effect of annealing plastics is to develop their maximum degree of crystallinity. Each plastic, because of its molecular structure and chemical constitution, seems to possess a limiting degree of crystallinity; but each varies in its rate of crystallization and in the amount of annealing required to establish the maximum state. In addition, the annealing conditions influence the growth of spherulites. On the other hand, quenching or rapid cooling can be used to produce a lower degree of crystallinity in the case of a polymer which crystallizes very slowly.

The principal controlling factors in annealing or quenching are temperature and time. This can be seen in the graph in Figure 3, which shows the growth of the crystalline fraction of a polymer that has been cooled rapidly from the melt to temperatures $T_1 > T_2 > T_3$. It can be seen that the higher temperature permits the growth of the maximum degree of crystallinity in the shortest time. Lower temperatures or more rapid cooling not only slow the rate of crystallization but reduce the attainable degree of crystallinity. Since plastics generally are poor conductors, the dimensions of the specimen must also be considered. Thicker cross sections will cause the center to cool more slowly than the skin, causing the formation of a crystallinity gradient. Other factors influencing the results of thermal treatment include the composition of the surrounding atmosphere (be it liquid or gas), character of any contacting surface, and pressure.

Mechanical Treatment

Another processing variable affecting the characteristics of crystalline polymers is mechanical treat-

ment. One type of treatment is known as orientation and involves stretching under controlled conditions. In the case of fibers, stretching of a monofilament in the direction of the deformation produces an increase in tensile strength. For example, unoriented nylon filament as extruded and quenched in air may have a tensile strength of 12,000 pounds per square inch of original diameter. Orientation by stretching the filament four or five times its length, yields a fiber with a corresponding tensile strength of 70,000 pounds per square inch or more.

Similarly, stretching can be used to change the performance characteristics of films. However, in many cases, it is important that film properties be equivalent in transverse, as well as longitudinal, directions; hence, it is necessary to stretch these polymers biaxially. This type of processing introduces a great number of technological problems, many of which had to be solved before polyethylene terephthalate film, for example, could be manufactured.

Fibers and films, unfortunately, are only very specialized forms of true materials of construction. In speaking in more general terms, we find that we are confronted with the extension of these principles of thermal and mechanical treatment to complex shapes, that not only have relatively thick cross sections, but must be held to close dimensional tolerances during processing in some cases. The obstacles to be overcome are extremely complex, and it is quickly realized that we have only scratched the surface in regard to understanding the behavior of these materials.

Applications of Crystalline Polymers

A number of unique applications of thermoplastic crystalline polymers are now under investigation in several laboratories including those of Battelle. In some cases, for example, these materials are being studied for uses where metals have been used extensively in the past. Plastics are being considered because of such advantages as lower cost, lighter weight, and greater durability. One specific application in which crystalline plastics will eventually become important is pipe. In this use, the desirable advantages of light weight and durability without sacrifice of strength become manifest. Supporting evidence of this prediction is seen in the already established position of pipe made of amorphous thermoplastics. The usefulness of this product, however, is limited to applications of relatively low stress. It is anticipated that the successful development of techniques for the fabrication of oriented crystalline thermoplastics into pipe will permit its utilization in all types of applications, including those now limited to brass, copper, or glass.

It is natural, of course, to attempt to apply methods and principles customarily used with metals, in shaping, working, or joining the segments of the plastic system, or in standardizing its performance. Such borrowing has sometimes been disastrous, particularly in early plastic pipe developments. We are now coming to realize that metal-working principles cannot always be applied to plastics; rather, we must adapt the principles or develop entirely new techniques. It is probable, that, as we learn more about performance and physical morphology of crystalline polymers, these characteristics and their relationships to the chemical processing variables will become controllable.

Need for New Polymers

The successful utilization of plastics in some engineering applications must await the development of new polymers. For example, no known commercial thermoplastic can be used in a continuous load-bearing application except where the forces involved are very small. The dimensional changes resulting from creep are likely to be quite large when loads of even 10 to 20 per cent of the ultimate strength of a thermoplastic are involved. The tolerable limits can be extended if crystalline polymers, modified by the techniques outlined above, are used; but, in most cases, the areas of elastic deformation and creep in these materials are still appreciable and preclude their use in heavy-duty engineering applications.

The situation continues to improve, however, and significant advances are likely in the reasonably near future. Recent advances in the use of heterogeneous catalysis in polymerization leading to the development of stereospecific polymers has spurred the investigation of ordered polymer molecules. We spoke previously of a polymer being partially crystalline and having entangled molecules. At the present state of development, another variable affecting the polymer characteristics involves the size and distribution of sizes of these molecules. The ultimate objective of the activity in the study of polymerization mechanisms, therefore, is to prepare a polymer which is a "pure" compound, in that all of the molecules will be identical in size and composition. This will be a major breakthrough and will permit true tailoring of polymer composition. This accomplishment, combined with an increased understanding of the effect of the thermal and physical treatment of plastics, will help to extend the applicability of crystalline thermoplastics into broad areas of usefulness as true materials of construction.

NOTES from BATTELLE

* PHYSICAL PROPERTIES AND SMELL

What makes some substances smell different from others? Why are some odors pleasant, others unpleasant? Odor is an important factor in taste, and the answers to such questions could lead to more flavorful foods.

To help the Army's Quartermaster Corps provide tastier rations for the nation's armed forces, scientists at Battelle are investigating the relation between physical properties of substances and their effect on the human sense of smell. The research is being done for the Quartermaster Food and Container Institute for the Armed Forces, a unit of the Quartermaster Corps' Research and Engineering Command.

"We know a great deal about other senses, such as vision and hearing," says Dr. Howard G. Schutz, a Battelle psychologist. "Much less is known about the sense of smell. The research at Battelle is now at a stage where we can study the physical properties of a substance chosen at random and accurately predict the strength and pleasantness of its odor about half the time."

The Battelle study is based on thirty odorous substances. They were among odorants selected to represent a wide range of typical scents by Quartermaster Corps scientists in previous research. Battelle research assistants sit in a closed "smelling booth", sniff odorants at thirty-second intervals, and report a description of each odor. The reported characteristics of the odors are then studied in relation to six physical properties of the odorant.

"Our research shows that these six properties are useful in predicting the characteristics of an odor, but more research will be needed to explain just why and how some properties affect smell," says Dr. Schutz. "In order to be smelled, a substance must come in contact with small areas of sensitive cells, far up in the nose. We have learned that a substance that evaporates readily usually has a stronger smell. It seems reasonable to think that such a substance reaches the sensitive cells more readily and in greater amounts. This may be why vapor pressure and surface tension have significance in odor. On the other hand, substances with a high ability to penetrate cell tissue usually have a weaker odor, as do substances with strong properties of adhering to surfaces. The abilities of substances to absorb heat and ultraviolet radiation are also linked to strength and pleasantness of smell. We are not sure what the nature of these relationships is, but our research shows that the relationships exist."

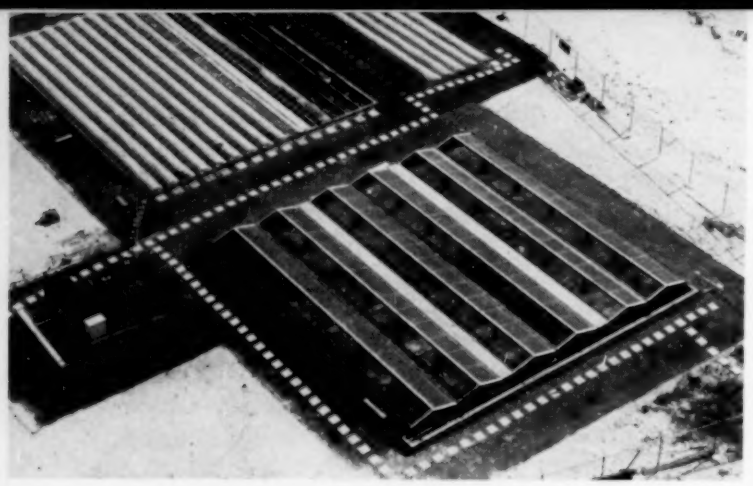
An interesting sidelight of the Battelle research: in working with the smelling booth, it was learned that a person's awareness of an odor decreases with the length of time he is exposed to it, but the introduction of a new odor finds the nose as sensitive as before.

* OIL ASH CORROSION

Corrosion of boilers by the ash of residual fuel oils has been a problem for only a decade. The intensified corrosion was first noticed with the advent of boilers producing steam at 1050-1100 F, leading to temperatures above 1200 F at some locations in the equipment. The problem also is a serious one in gas turbine engines and became apparent with their first use. While the composition of residual oil ash varies widely, the bulk of the ash consists of compounds of vanadium, iron, nickel, sulfur, and the alkali metals. Of these, compounds of vanadium, sodium, and sulfur are particularly important because of their accelerated corrosion effects at high temperatures.

Speaking before the Elevated Temperature Corrosion Symposium in Chicago recently, Battelle metallurgist Charles J. Slunder reviewed possible steps for combatting such corrosion. He pointed out that low-melting compounds, which appear to act as oxygen carriers to speed up corrosion at the metal-oxide interface, are difficult to cope with, and no economical methods for their removal have been found. At the same time, existing heat-resistant alloys appear unable to stand up satisfactorily in the corrosive environments of boilers and gas turbines. However, studies of alloys containing silicon and aluminum show that such additions are beneficial to materials designed for such conditions.

Protective coatings, Slunder reported, have generally proved unsatisfactory. Some, though they have fair inherent corrosion resistance, fail by cracking and



An aerial view of the solar-still research station of the Department of Interior's Office of Saline Water, which is operated by Battelle. The glass-covered, deep-basin still is in the foreground. Behind it are the two shallow-basin plastic stills. The small building in the left foreground houses extensive instrumentation which provides data for evaluating the performance of the stills. Additional experimental stills are being planned.

undermining. Concentrating the beneficial elements in the surface layer of the metal may give better results.

Oil additives have received the greatest attention. The purpose here is to add materials such as calcium, magnesium, aluminum, and silicon to the oil, which will form compounds that are solid at operating temperatures. While some compounds are effective, they do not provide equal protective effects for all impurities, operating conditions, and materials of construction.

A better basis for future work, the Battelle metallurgist concluded, is to be found in studies of the basic mechanism of corrosion, in phase equilibrium relationships in systems comprising the harrmful elements in residual oils, and in the thermochemical studies of additives.

* SOLAR CONVERSION OF SEA WATER

"It appears that the best chances for expanded use of solar stills for conversion of sea or brackish water", states Frank A. Seaton, Secretary of the U. S. Department of the Interior, "are in isolated areas and in certain arid regions where solar intensities are high and where conventional fuels are expensive". As a step in developing techniques for meeting water needs in such areas, three experimental solar stills for study of sea water conversion have been built at a seashore solar research site near Port Orange, Florida. The stills were built under the direction of, and will be operated, evaluated, and developed by, Battelle technologists.

Dr. A. L. Miller, Director of the Office of Saline Water, reports that one of the stills, designed by Dr. George O. G. Löf, is a 2400-square-foot deep-basin, glass-covered structure. The other two (500 and 2300 square feet) for which the E. I. Du Pont de Nemours and Company supplied basic designs and plastic materials, are shallow-basin plastic stills whose covers are air supported. The three stills are of sufficient size to allow evaluation of their engineering features and to obtain reliable data on construction, operation, and maintenance costs. James A. Eibling, Richard A. Collins, and John W. Bloemer, all of Battelle, are associated with the study.

The stills consist of black-bottomed basins with transparent covers. The vapor, produced from sea water in the bottom of the basins, condenses on the inside of the cover and runs down channels at the edges of the basin for collection. The three stills are expected to produce a total of about 500 gallons of fresh water per day.

* REACTOR'S POWER DOUBLED

The power level of Battelle's research reactor has just been doubled, raising its normal operating level to two million watts.

According to Dr. H. R. Nelson, manager of the Institute's atomic energy activities, by doubling the intensity of neutrons and gamma rays produced by the reactor, significant gains can be made in research programs now under way and in ones envisioned for the future. The increase in power will be of particular immediate value, he said, in capsule and in-loop research programs being conducted to obtain a more complete understanding of the effects of radiation on various fuel-element designs and the environments in which they will operate. Working with the higher radiation level, scientists can more nearly approximate actual conditions in reactors designed to produce electrical power.

On this last point, Dr. Nelson emphasized that while the increased power level of the reactor enhances its usefulness in research for the electrical power generating industry, the step-up in power does not change the basic purpose of the reactor. It is a research reactor, he said, and its value lies solely in its ability to provide intense radiation.

Experience gained in operating the reactor at one million watts since late in 1956 paved the way for the

recent move to the two-million watt level. Since more than 10 per cent of the uranium in the original fuel elements had been burned up when the decision for increased power was made, new fuel elements were installed while other modifications were being made for operation at the two-million watt level. The Atomic Energy Commission granted permission for the stepped-up operating level late in the month of February.

During the first year of two-million watt operation, the reactor will be run occasionally at three million watts, but not for more than a total of two weeks out of the year. This intermittent operation will allow an evaluation of the system at the highest power level, yet will not, in general, affect research programmed for two-million watt power.

* A method for preparing high-softening-point or hard rosins from tall oil was described in a paper presented last month before the American Chemical Society's National Meeting. The authors, Battelle chemist E. E. McSweeney and R. D. Bitting, formerly of Battelle, report that if maleic anhydride is preesterified and then reacted with rosin in the presence of an acid catalyst, tall oil rosin esters can be given softening points as high or higher than comparable gum rosin esters. The process has the additional advantage of more effectively utilizing maleic anhydride. The development has significance because tall oil rosin is likely now to be used more widely in varnishes, lacquers, and inks, since price alone will not be the governing factor in its selection.

* Recent appointements of Battelle staff members to key technical posts include: F. L. Bagby—member, Technical Committee for Structures and Materials, American Rocket Society; R. S. Boyd—member, Committee on Nuclear Instrumentation, American Institute of Electrical Engineers; R. B. Filbert, Jr.—chairman, Missiles and Rockets Symposium, American Institute of Chemical Engineers (Atlanta, 1960); E. L. Kropa—member, Committee on Heat Attenuation in Clothing Systems, Advisory Board on Quartermaster Research and Development; L. S. O'Bannon—secretary, Enamel Division, American Ceramic Society; W. T. Reid—vice chairman, Fuels Division, American Society of Mechanical Engineers; L. B. Sibley—chairman, Lubrication Division Subcommittee on Boundary Lubrication and Bearing Materials, American Society of Mechanical Engineers.

Writings by STAFF Members

American Institute of Mining, Metallurgical, and Petroleum Engineers, Transactions, Metallurgical Society, v. 215, no. 1, February, 1959, contains the following papers by staff members:

Surface Tension and Contact Angles in Some Liquid Metal-Solid Ceramic Systems at Elevated Temperatures. B. C. Allen and W. D. Kingery, pp. 30-37.

Surface tension and its temperature dependence were determined for pure liquid Fe, Cu, Co, Ni, and Sn, and for Fe-C, Co-C, and Ni-C alloys. The surface tension and wetting behavior of Sn and Sn-Ti alloys on Al_2O_3, Si_3N_4, $MoSi_2$, and SiC, as well as the behavior of Ti containing Ni alloys on Al_2O_3 were determined over a wide temperature range. Some limits for the solid-surface energies were calculated from liquid surface tension and wetting behavior.

Microbeam Analysis of Widmanstatten Structure in Meteoritic Iron. R. E. Maringer, N. A. Richard, and A. E. Austin, pp. 56-58.

American Society of Mechanical Engineers, Transactions, Series B, *Journal of Engineering for Industry*, v. 81, no. 1, February, 1959, contains the following articles by staff members:

Helical Springs of Hollow Circular Cross Section. C. W. Bert, pp. 30-36.

A theoretical and experimental investigation of elastic shear stresses and deflection in an axially loaded helical spring having a hollow circular section is reported. Two analyses are presented: An approximation of the stresses by strength-of-materials theory and a more accurate elasticity-theory solution for stresses and deflection. The results are compared with strain and deflection measurements on an actual tubular spring.

Drilling by Vibration. R. Simon, pp. 67-76.

An analysis is presented of the process of vibratory drilling, based on the assumption that the load presented by the bit vibrating on the rock to the vibration generator, a magnetostriction transducer, can be represented by a force-displacement characteristic with hysteresis. The conclusions reached are compared with experimental observations on the performance of vibratory drilling systems.

Metals for Supersonic Aircraft and Missiles, American Society for Metals, Cleveland, 1958, contains the following papers by staff members:

Protective Metallic Coatings. Charles L. Faust, pp. 170-201.

The world "coating" usually implies an intimate or "skin-tight" covering applied after a part or structure is in its final bulk form. On the basis of properties at very high temperature, methods of application and properties of their alloys, the metals in Table I have received the most attention as coatings. The temperature to be reached in serv-

(next page)

Members of the Battelle staff are authors of the recently published articles and books listed on these pages. In most cases, reprints are available from the Battelle Publications Office, 505 King Avenue, Columbus 1, Ohio.

ice, the time at temperature, and the size and complexity of the part will indicate which of the metals is a coating prospect and which of the processes should be used for applying the coating. The following factors will determine whether the coating will provide the desired heat tolerance:

Oxidation (and/or corrosion) resistance.
Thermal stability.
Coeffiicent of thermal expandion relative to that of the basis metal.
Propensity for diffusion alloying with the basis metal at the interface.
Properties of such a diffusion alloy zone relative to the performance needs.
Melting point of the coating and of the diffusion alloy zone.

Titanium Alloys. Robert I. Jaffee, pp. 406-411.

Perhaps the greatest immediate need is for much higher strength (approaching 200,000 psi when tested at room temperature) for use in aircraft forging and sheet applications at 600 to 800 F. This is a large jump in strength from the alloys currently being used having strengths of 110,000 to 120,000 psi. Any such strength level dictates heat treatment, and this in turn requires alpha-beta or beta alloys.

Radioisotope Techniques. G. D. Calkins. Paper from *Proceedings of the Inter-American Symposium on the Peaceful Application of Nuclear Energy*, May 1957, pp. 293-299.

One of the major values of radioisotopes lies in their use as tools or aids in solving problems. An understanding of the versatility of these tools may be gained by considering some of the techniques that have been used in the past. Three applications of radioisotopes to the solution of industrial-research problems are described; penetration of moisture into protective coatings, distribtuion of rare-earth additions in steel, and grinding-ball wear.

Metallography of Uranium. R. F. Dickerson. *American Society for Metals, Transactions*, v. 52; *Preprint No.* 120, June 4, 1958, 22 pp.

Summarizes the current state of the art of uranium metallography. Describes the various allotropic transformations and the crystallography of these phases. Common heat-treating temperatures and recrystallization temperatures are listed. Surveys nonmetallic inclusions. Typical photomicrographs illustrating these inclusions are shown, and some of the current thinking concerning the UO and UN group is discussed briefly.

Preparation and Properties of Dense Beryllium Oxide. Collin Hyde, J. F. Quirk, and W. H. Duckworth. *Ceramics*, v. 10, February 1959, p. 10 + 5 pages.

Demonstrates that high-purity BeO shapes of nearly theoretical density can be made without resorting to severe ceramic-processing measures. Proper calcination of a suitable starting compound appears to be the major factor in obtaining readily sinterable BeO powder. Dense BeO ceramics made from active powder had high strengths when sintered at temperatures low enough to prevent excessive crystal growth. Bend strengths decreased with increasing sintering temperatures in a manner indicating that fracture strength was inversely proportional to the average crystal diameter.

The Physical Metallurgy of Titanium Alloys. R. I. Jaffee. Paper from *Progress in Metal Physics*, v. VII, pp. 65-163 + 5 plates. 1958. Pergamon Press, New York.

Shows that the alloying nature of titanium is such that it will form etxensive solid-solution alloys with all of the transition elements and, also, with those nontransitional elements of relatively low valence which make a good atomic size fit with titanium and which do not boil at temperatures appreciably below the melting point of titanium. In addition, the potentialities for oxygen, nitrogen, and carbon are good because of titanium's transitional nature, and the relative diameter ratios are favorable.

A Study of a Serrated Ridge Waveguide. H. S. Kirschbaum and R. Tsu. *IRE Transactions on Microwave Theory and Techniques*, v. MTT-7, no. 1, January, 1959, pp. 142-148.

The serrated, or periodically slotted ridge produces a periodic loading which retards the phase velocity of the wave in a waveguide. Such structures may be used to provide a variable index of refraction for microwave lenses and as elements in microwave filters. Two approaches are presented in this paper giving the frequency dependence of the index of refraction. Circuit parameters which determine the shape of the index of refraction curve are calculated from the experimental data. A purely analytic expression of the index of refraction is derived by a field matching method. Calculations show good agreement with test data.

Investigation of the Properties of Tantalum and Its Alloys. William D. Klopp, Fred R. Schwartzberg, Frank C. Holden, Chester T. Sims, H. Russell Ogden, and Robert I. Jaffee. U. S. Air Force, Wright Air Development Center, *WADC Technical Report* 58-525, November 1958, 78 pp.

A survey of literature pertaining to tantalum and tantalum alloys is reported in narrative style with references to published data. A bibliography of available publications is included. Emphasis was placed on subjects pertinent to the research being conducted on this project with a more general coverage of other subjects.

Higher Temperature Metals and New Forming Methods Mark 1958 as Year of Progress in Metals. Clarence H. Lorig. *Industrial Heating*, v. 26, January 1959, p. 46 + 4 pages.

Melting metals in jets of heat ranging up to 30,000 F, steels with strengths exceeding 400,000 lb. per square inch, perfection of techniques for the forming of metal parts by controlled explosions and the rolling of metal strip directly from metal powders are among the outstanding metals engineering developments of 1958.

A Contribution to the Analysis of Polycyclic Aromatic Hydrocarbons in the Exhaust Gases of Diesel Motors. (*In German.*) Beitrag zur Analyse polycyclischer aromatischer Kohlenwasserstoffe in den Abgasen von Dieselmotoren. A. Reuter, K. O. Johne, and J. Lieb. *Zeitschrift fur Analytische Chemie*, v. 164, no. 3, 1958, pp. 335-337.

An analysis of the soot deposited by exhaust gas revealed the presence of polynuclear aromatic compounds such as anthracene, pyrene, 3,4-benzopyrene, 1-12-benzoperylene, fluoranthene, and 11, 12-benzofluoranthene. The analysis resembled that of 3,4-benzopyrene in diesel soot, except for some important variants. A portion of the exhaust gases was conducted at the rate of 50 to 100 liters per minute onto a filter impregnated with silicone oil. The extracts obtained were subjected to a paper chromatographic examination after separation on an Al_2O_3 column. The most favorable concentration for paper chromatography was found to be $1\text{-}2 \cdot 10^{6}$ g. per component. The Rf values of each substance varied according to the concentration and the size of the paper stain. There was also an effect of the depth of immersion of the chromatographic paper into the solvent, so that this depth and the concentration of the substances tested should be maintained as constant as possible during the analysis.

Constitutional Diagrams of Uranium and Thorium Alloys. Frank A. Rough and Arthur A. Bauer. 153 pp. 1958. Addison-Wesley, Reading, Mass.

This cooperative compilation of United States and United Kingdom uranium and thorium constitutional diagrams is a highly useful source of reference material. It is divided into sections on uranium and thorium alloys. The systems are arranged in alphabetical order.

Alloying by Powder Metallurgy. H. A. Saller and F. A. Rough. Paper from *Powder Metallurgy in Nuclear Engineering*, p. 120-140, 1958. American Society for Metals, Cleveland.

Describes effects of processing variables on alloy formation and gives examples of application of the process to formation of U-Zr, U-Al, and other alloys.

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AERONAUTICAL ENGINEERING

4884 Selection of an Aerodynamic Configuration for Improved Beam Rider Guidance. Improvement in response can be achieved either by an aerodynamic configuration which provides a very high missile pitching frequency or alternatively by a configuration which obtains all the lift by wing deflection alone. A no-angle-of-attack missile eliminates the dependence of missile response on altitude. This configuration yields substantial improvements in beam riding performance at high altitude. ***Basil Staros, Richard Gretz, and Merven Mandel.*** *ARS Journal,* v. 29, Feb. 1959, p. 115-118.

4885 Transducer Frequency Response Evaluation for Rocket Instability Research. Several pressure transducers were evaluated through the use of a shock tube to obtain the transient response to step pressure excitation. The resultant transient response is analyzed to obtain characteristics, such as rise time, per cent overshoot, and per cent damping. ***Charles R. Tallman.*** *ARS Journal,* v. 29, Feb. 1959, p. 119-122.

4886 Laminar Heat Transfer on Three-Dimensional Blunt Nosed Bodies in Hypersonic Flow. In the presence of highly cooled surfaces and of moderate Mach numbers at the outer edge of the boundary layer, the crossflow in the boundary layer is negligible even for large transversal pressure gradients. A rapid method for estimating the heat transfer over the nose portion of arbitrary three-dimensional blunt bodies in hypersonic flight is derived. Procedure for obtaining streamlines from a pressure distribution measurement is outlined. ***Roberto Vaglio-Laurin.*** *ARS Journal,* v. 29, Feb. 1959, p. 123-129.

4887 An Experimental Investigation of Blunt Body Stagnation Point Velocity Gradient. Tests were conducted in supersonic wind tunnel at Mach numbers of 2.01, 3.01, and 4.76, and at Reynolds numbers (based on body diameter) of from 1 to 1.5 million. Pressure distributions were obtained to a high degree of accuracy by micromanometer techniques and by the use of numerous pressure orifices. Two shock detachment correlations were obtained, one using an effective nose radius parameter to compare bodies of varying bluntness with shock density ratio, and the other using a bluntness parameter to obtain an almost linear variation of shock detachment distance and shock sonic point location. ***J. Christopher Boison and Howard A. Curtiss.*** *ARS Journal,* v. 29, Feb. 1959, p. 130-135.

4888 Helicopter Ground Resonance. The Effect of Rotor and Fuselage Damping. Results are displayed graphically and reveal the dependence of the unstable range on rotor and fuselage damping. Some of the conclusions are in disagreement with those reached by Coleman. Both viscous and friction rotor dampers are considered. ***W. E. Hooper.*** *Aircraft Engineering,* v. 31, Feb. 1959, p. 32 + 7 pages.

4889 Induced Flow Near a Helicopter Rotor. Basis and extent of theoretical induced velocity calculations are reviewed. The theory is applied to interference problems involving additional rotors, wings, and tails in the flow. For hovering, superposition is used to introduce ground effect into the calculations. The resulting flow field offers a qualitative explanation of several previously observed phenomena. ***Harry H. Heyson.*** *Aircraft Engineering,* v. 31, Feb. 1959, p. 40 + 4 pages.

4890 On the Retardation of a Satellite. As the satellite is slowed down by the tenuous upper atmosphere, its period is shortened; the greater the energy losses, the greater the shortening of the period. This surprising result is explained. ***Ralph Hoyt Bacon.*** *American Journal of Physics,* v. 27, no. 2, Feb. 1959, p. 69-72.

4891 Man in Space. A collection of 11 articles covering several problems of manned spaceflight including isolation, biodynamics, weightlessness, space cabin atmosphere, psychophysiological problems, water recovery, closed-cycle breathing/ventilation system, and acceleration. *Astronautics,* v. 4, Feb. 1959, p. 18-41.

4892* Nike-Ajax: An Integrated Guided-Missile System. General description of the first operational Nike-Ajax guided missile system. ***J. L. Troe.*** *Bell Laboratories Record,* v. 37, Feb. 1959, p. 53-58.

4893 The Technology of Manned Return From Outer Space. Manned flight in space is more than just "within the present state of the art". Almost all of the technology has been proven, most of the hardware is available, and the remaining parts of the system are in the design stage. Only modest steps are required, those of orienting the design to the parameters dictated by the human occupant. ***Hilliard W. Paige.*** *Franklin Institute, Journal,* v. 267, no. 2, Feb. 1959, p. 103-118.

4894 Preliminary Investigations of Spiked Bodies at Hypersonic Speeds. An examination of the flow over blunt bodies equipped with a spike to minimize heat-transfer rates. The use of a spike protruding from a hemispherical-nosed cylinder at M = 14 decreased the pressure level by an order of magnitude and the heat transfer to a fraction of that measured on a hemisphere without a spike. The general technique appears to hold considerable promise for hypersonic flight. ***Seymour M. Bogdonoff and Irwin E. Vas.*** *Journal of the Aero/Space Sciences,* v. 26, Feb. 1959, p. 65-74.

4895 A Linearized Analysis of the Forces Exerted on a Rigid Wing by a Shock Wave. Solutions are obtained in closed form for the pressures exerted on a rigid half plane by an incident, plane acoustic shock wave. The angle of incidence of the wave front is arbitrary and the half plane is considered to be traveling at constant velocity, subsonic or supersonic with respect to the acoustic medium. A closed-form solution is obtained also for a rigid wedge which is motionless with respect to the acoustic medium. The analysis is carried out by transforming the wave equation to Laplace's equation by the Busemann conical transformation and then applying conformal mapping. ***F. Edward Ehlers and E. M. Shoemaker.*** *Journal of the Aero/Space Sciences,* v. 26, Feb. 1959, p. 75-80.

4896 On Panel Flutter in the Presence of a Boundary Layer. The energy transfer from the uniform flow outside a boundary layer to a transverse surface wave at the boundary is calculated on the hypothesis that the boundary layer may be represented by an invisicid, approximately parallel shear flow. ***John W. Miles.*** *Journal of the Aero/Space Sciences,* v. 26, Feb. 1959, p. 81-93.

4897 Dynamic Longitudinal Stability Equations for the Re-Entry Ballistic Missile. The limitations of the linearized equations predicting the dynamic stability during rapid deceleration of a nonrolling missile are discussed for the usual ballistic missile which has a longitudinal plane of symmetry and is trimmed to fly at a nearly zero angle of attack trajectory. ***E. V. Laitone.*** *Journal of the Aero/Space Sciences,* v. 26, Feb. 1959, p. 94-98.

4898 Supersonic Airfoil Performance With Small Heat Addition. An analytical method is presented which permits a very rapid evaluation of the aerodynamic effects arising from the addition of small amounts of heat near supersonic two-dimensional air-foils. It is shown that even small amounts of heat generate a substantial pressure rise and thus cause appreciable changes in the aerodynamic coefficients. ***Artur Mager.*** *Journal of the Aero/Space Sciences,* v. 26, Feb. 1959, p. 99-107.

4899 Metals for Supersonic Aircraft and Missiles. Proceedings of the conference, "Heat Tolerant Metals for Aerodynamic Applications", held January 28 and 29, 1957 at the University of New Mexico, Albuquerque, New Mexico, under the joint sponsorship of American Society for Metals and University of New Mexico. ***D. W. Grobecker, editor.*** 423 pp. 1958. American Society for Metals, Cleveland. (TL699.M4 M56)

4900 Problems Relating to the Need for Heat Tolerant Materials in Aerodynamic Applications. Within the past 20 years, two major impediments to increasing flight speeds have been encountered. The first was the existence of a large drag rise as flight Mach numbers of unity were approached. As flight speeds approached this magical Mach number, the rate of drag increase was so large that some felt that a Mach number of one would never be exceeded. Thus, the term "sonic barrier" was applied to the phenomenon. In retrospect, the problem posed by the sonic barrier was not so formidable as it may have seemed when first observed. ***P. W. Rowe.*** Paper from "Metals for Supersonic Aircraft and Missiles", p. 4-20, 1958. American Society for Metals, Cleveland. (TL699.M4 M56)

4901 Metals for Structures Exposed to Aerodynamic Heating. Above moderate speeds, effects of aerodynamic heating and secondary effects of higher temperatures have to be taken into account in addition to the strength requirements, and materials have to be selected for a well-balanced combination of thermal and mechanical properties. As long as such materials can be provided, an integral structure can be used which differs from the conventional structure not by design but by the criteria for selection of materials and determination of dimensions. ***Wolfgang H. Steurer.*** Paper from "Metals for Supersonic Aircraft and Missiles", p. 21-47, 1958. American Society for Metals, Cleveland. (TL699.M4 M56)

4902 Materials Property Requirements and Test Methods for Aerodynamic Applications. A general review of the major properties of materials required and the test methods used to evaluate materials for aerodynamic applications. Illustrates interdependence of material properties, test methods, and aerodynamic design requirements. ***Louis Luini.*** Paper from "Metals for Supersonic Aircraft and Missiles", p. 48-95, 1958. American Society for Metals, Cleveland. (TL699.M4 M56)

4903 AISI and Stainless Steels for Aerodynamic Applications. Every aircraft and missile manufacturer is searching constantly for newer materials and re-evaluating older, established metals and alloys to obtain the maximum or optimum properties. This evaluation involves the investigation of all possible heat treatment, forming, and fabrication techniques. Many complicated missile designs require combinations of heat treating and forming to achieve satisfactory parts. The stretch-aging of 17-7PH is an example of the latter. ***J. T. Milek and B. L. Molander.*** Paper from "Metals for Supersonic Aircraft and Missiles", p. 217-233, 1958. American Society for Metals, Cleveland. (TL699.M4 M56)

4904 Performance of Materials at Elevated Temperatures for Aircraft and Missile Applications. The principal source of heating to the airframe and missile designer is aerodynamic heating. In addition to this type of heating, however, the heat generated from the combustion process occurring in the powerplant must also be considered. ***Alan V. Levy.*** Paper from "Metals for Supersonic Aircraft and Missiles", p. 369-399, 1958. American Society for Metals, Cleveland. (TL699.M4 M56)

4905* The Mechanism and Application of Effusion Cooling. Internal heat transfer between the porous material and coolant is considered, and the heat transfer coefficient is obtained from experiment. An approximate analysis for the heat insulating effect is given. Manufacture of porous materials is discussed briefly and a representative list of commercially available materials is included. The application of effusion and sweat cooling to the blading and combustion chamber linings for gas turbines, rocket motors, and the outside skin of flying vehicles is considered. ***P. Grootenhuis.*** *Royal Aeronautical Society, Journal,* v. 63, Feb. 1959, p. 73-89.

4906* A Theoretical Treatment of the Flutter of a Wing With a Localised Mass. Flutter calculations were made on a fixed root model wing carrying a localised mass. Modes were calculated for the wing for certain conditions of restraint. Extended calculations show that there is an optimum spanwise position for a localised mass, and that this optimum position is related to the nodal line position in the overtone torsion mode of the bare wing. ***D. R. Gaukroger.*** *Royal Aeronautical Society, Journal,* v. 63, Feb. 1959, p. 95-103.

4907 Missiles Mean Big, Risky Business. The Advanced Research Projects Agency will launch several satellites in 1959, starting with a 1300 lb. object, and possibly ending with a 10,000 lb. one. Steps to manned space craft include the X-15 and Boeing's Dyna-Soar. *Steel,* v. 143, Dec. 29, 1958, p. 30-31.

4908 Theoretical Investigations of Sonic Boom Phenomena. An investigation was made to determine the pressure and shock wave characteristics due to a body (i.e., aircraft) in arbitrary motion. In addition, the propagation of these shocks through the atmosphere was studied, and the effects of many parameters such as Mach number, acceleration, altitude, and slenderness ratio were determined. This program was completely theoretical in nature. *U. S. Air Force, Wright Air Development Center, WADC Technical Report* 57-412, Aug. 1957, 231 pp. (TL507 Un3.18w Vis.)

See also: **4930** (aviation medicine); **5532** (verbal communications in missile engineering); **5627** (steels for aircraft); **5628** (properties of light metal aircraft structures); **5998** (noise in jet engines); **5999** (noise in jet engines); **6000** (noise in jet engines).

AGRICULTURE

4909 Advances in Pest Control Research. A book offering a selection from recent significant research trends related to all phases of pest control, with emphasis on the fundamental aspects and covering such topics as the fluid kinetics of application of pesticidal chemicals, innate toxicity of fungicides, seed and soil treatment with systematic and nonsystematic insecticides, isotope dilution techniques for the determination of pesticide residues, etc. ***R. L. Metcalf, editor.*** v. II. 426 pp. 1958. Interscience Publishers, New York. (SB951 Ad95 Vis.)

4910* Economic Potential in Utilization of Organic Wastes. Farm wastes and sewage sludge. ***M. S. Anderson.*** *Agricultural Chemicals*, v. 14, Feb. 1959, p. 30-33.

4911 Engineering Appraisal of Hay Pelleting. Success in mechanizing the storage and feeding of hay calls for a new hay package to facilitate handling and feeding operations. ***John B. Dobie.*** *Agricultural Engineering*, v. 40, Feb. 1959, p. 76 + 3 pages.

4912 Two Companies Join to Declare Amylomaize Possibilities Are Big. Describes basic properties of amylose and economic advantages to industrial users of end products. *Chemurgic Digest*, v. 18, Jan. 1959, p. 5-6.

4913 Stability of Certain Insecticides in Mixtures With Fertilizers. Most mixtures had good stability for at least 1 month at 30 C with losses of organic chlorine varying from negligible to more than 50% on aging for 8 months. At 100 C, nearly all mixtures were unstable, and lost approximately 20% of their organic chlorine in the first 24 hours. Instability of insecticides in fertilizer mixtures was related to minor characteristics of the fertilizer, such as iron content and surface acidity. ***R. M. Creamer and T. G. Lamont.*** *Journal of Agricultural and Food Chemistry*, v. 7, Feb. 1959, p. 107-111.

4914* A Proposed System of Genetic Soil-Horizon Designations. *E. P. Whiteside.* *Soils and Fertilizers*, v. 22, no. 1, Feb. 1959, p. 1-8.

4915 Weeds in Temperate Regions. I. This first part of a report on the Fourth British Weed Control Conference contained short abstracts of selected papers in relation to the control of roadside vegetation, advances in total weed control, total herbicides, the weed problem in rivers and drainage channels, and the control of aquatic weeds by copper sulfate. *World Crops*, v. 11, Feb. 1959, p. 66-68.

See also: **4986** (applications of nuclear energy).

BIOCHEMISTRY AND BIOPHYSICS

4916* Characterisation of Different Types of Leukocyte Agglutinins. Five leukoagglutinins of different etiology (auto-agglutinins, agglutinins of collagen disease and immuno-iso-agglutinins) were shown to be γ-globulins. ***Sven-Åge Killmann and Niels Harboe.*** *Acta Pathologica et Microbiologica Scandinavica*, v. 45, no. 1, 1959, p. 12-16.

4917* Mitotic Activity in Mouse Epidermis During the Induction Period of Papillomas. Mitotic activities were determined in mouse epidermis following the application of 9,10-Dimethyl-1,2-benzenthracene (DMBA) in different concentrations and compared with the lengths of the induction periods of papillomas. It was found that the higher the incidence of mitoses in the epidermis treated with DMBA, the shorter the induction period of tumors. These results were discussed in connection with a possible mechanism of carcinogenesis. ***Roger Daoust.*** *Acta Pathologica et Microbiologica Scandinavica*, v. 45, no. 2, 1959, p. 159-166.

4918 Advances in Biological and Medical Physics. A collection of 12 papers outlining recent progress in research and research methods in the following areas: ion and water transport, periodicity in living cells, induction of lysogenic bacteria to produce phage with radiation, radiation and tumors, fallout, the central nervous system, diabetes, deoxyribonucleic acid, the muscle proteins, and mechanisms in the injury of cells by ionizing radiations. ***Cornelius A. Tobias and John H. Lawrence, editors.*** v. VI. 639 pp. 1958. Academic Press, New York. (QH505 Ad95 Vis.)

4919* On the Ways Ionizing Radiation Is Found to Affect the Content of Free Nucleotides and Nucleosides of Marrow. Investigations of mouse marrow revealed that whatever was the exposure to radiation—direct or through a screen—after 6 hours, there is an important decrease of the amount of nucleotides. With remote radiation effects, the decrease is about the same as in cells locally exposed to light. Hence, in the case of tissues indirectly exposed to light, the variation of the nucleotide content was fundamentally caused by the remote action of radiation. (*In Russian.*) O putiakh vliianiia ioniziruiushchei radiatsii na soderzhanie svobodnykh nukleotidov i nukleozidov v kletkakh kostnogo mozga. ***V. Ia. Brodckii, E. Ia. Graevskii, and I. A. Suetina.*** *Akademiia Nauk SSSR, Doklady*, v. 124, no. 2, Jan. 11, 1959, p. 440-443.

4920 The Preparation of High Molecular Weight Polypeptides. A method is described for the preparation of polypeptides of very high molecular weight, i.e., with weight average molecular weights as high as 1,000,000. The method involves intermolecular condensation of lower molecular weight polypeptides using carbodiimides as the condensing agents. It has been used with both organo-soluble polypeptides and water-soluble polypeptides and to prepare block copolymers. Examples are given of the preparation of high molecular weight poly-γ-benzyl-L-glutamate, poly-ϵ-carbobenzyloxy-L-lysine and poly-L-proline. ***E. R. Blout and M. E. Des Roches.*** *American Chemical Society, Journal*, v. 81, Jan. 20, 1959, p. 370-372.

4921 Rh Factors Related to the Rho Factor as a Source of Clinical Problems. Diagrammatic representation of their reactions and prediction of still undiscovered Rh factors. ***Alexander S. Wiener.*** *American Medical Association, Journal*, v. 169, no. 7, Feb. 14, 1959, p. 696-699.

4922* The Importance of Nucleic Acids for the Reproduction of Viruses. Details of structure and reproduction mechanism of viruses are explained using tobacco mosaic virus as a model. (*In German.*) Die Bedeutung der Nucleinsäuren für die Virus-Vermehrung. ***G. Schramm.*** *Angewandte Chemie*, v. 71, no. 2, Jan. 21, 1959, p. 53-57.

4923* An Essay on the Interpretation of the Functioning of Living Cells Based on Quantum Cybernetics. The basic hypothesis proposes that any living cell, considered from a physical point of view, functions as a micro-cybernetic electromagnetic system governed by the laws of quantum mechanics. In the course of this study, a model was adopted in which the system consists essentially of a primary source of quantized information emitted in the form of photons with a code defined by its ordered chemical structure and secondary sources and specific effectors in resonance with the primary source. (*In French.*) Essai d'interprétation du fonctionnement des cellules vivantes dans le candre de la cybernétique quantique. ***J. Polonsky.*** *Annales de Radioélectricité*, v. 13, no. 54, Oct. 1958, p. 346-370.

4924 Annual Review of Entomology. Contains 19 authoritative critical reviews on subjects such as insect blood cells and pigments; biology of aphids; experimental host-parasite populations; biological control of weeds with insects; the mode of action of insecticides; and seed treatment as a method of insect control. ***Edward A. Steinhaus and Ray F. Smith, editors.*** v. IV. 467 pp. 1959. Annual Reviews, Inc., Palo Alto, Calif. (QL461 An78 Vis.)

4925* The Simultaneous Action of Two or More Antibacterial Agents. The Action of the Combination Nitrofuratoin-Chloramphenicol-Erythromycin on *Proteus vulgaris*. The antibacterial potencies of combinations of two or

more drugs *in vitro* may be compared with those of the single drugs therein by two methods: (1) the action of the combination may be classified into categories, depending on the number of single drugs in the combination and (2) precise quantitative criteria reveal the action of any mixture to be either synergistic, additive, or antagonistic and the exact degree of synergism or antagonism. An "activity quotient" may be calculated from *in vitro* studies and used as a first approximation of the clinical effect to be expected. Standardization of terms and methods would resolve many difficulties besetting bacteriological and clinical studies with combinations of antibacterial agents. ***A. J. Zwart Voorspuij and L. H. Bokma.*** *Antibiotics & Chemotherapy*, v. 9, Jan. 1959, p. 27-37.

4926* Penicillin Sensitivity as Compared With Nucleic Acid Phosphorus Content of Virulent and Avirulent Strains of *Bacillus anthracis* and *Bacillus cereus*. *E. O. Bennett, G. E. Peterson, and R. P. Williams.* *Antibiotics & Chemotherapy*, v. 9, Feb. 1959, p. 115-120.

4927* The Effect of Two Antibiotics (23-21 and 1779) Upon Experimental Tumors. In the case of single intraperitoneal administration, LD_{50} of antibiotic 23-21 makes up 452 γ/kg, while LD_{50} of antibiotic 1779 makes up 745 γ/kg. Both in *in vitro* and *in vivo* experiments the antibiotics were found to produce an inhibitory effect upon the growth of Ehrlich's ascitic cancer in mice. (*In Russian.*) Deĭstvie dvukh antibiotikov (23-21 I 1779) na eksperimental'nye opukholi. ***Siun Bin, Liu Min-Chzhan, U. De-Chzhen, Tsiuu Tzziun'-Tsin, and V. Kurilovich.*** *Antibiotiki*, v. 3, no. 6, Nov.-Dec. 1958, p. 5-8.

4928* Isolation and Base Composition of DNA From Normal and Tumorous Carrot Tissues. Both types of DNA had the same base composition characterized by a high 5-methylcytosine content. ***Alan J. Thomas.*** *Archives of Biochemistry and Biophysics*, v. 79, Jan. 1959, p. 162-164.

4929* On the Mechanisms of Skeletal Fixation of Strontium. I.-II. I. ***G. E. Harrison, E. Lumsden, W. H. A. Raymond, and A. Sutton.*** II. ***J. Boyd, W. F. Neuman, and H. C. Hodge.*** *Archives of Biochemistry and Biophysics*, v. 80, no. 1, Jan. 1959, p. 97-113.

4930 Aviation Medicine. Selected Reviews. A condensed guide to specialized sources of data related to spirometric methods, high-speed motion picture photography as an aid in bio-medical investigation, measurements of atmospheric ozone, methods and apparatus for the study of stress reactions and metabolic changes, etc. ***Clayton S. White, W. Randolph Lovelace, II, and Frederic G. Hirsch, editors.*** 305 pp. 1958. Pergamon Press, New York. (TL555 L94a)

4931* A Comparison of the Serum Proteins of Normal Rats With Those of Rats Bearing Liver Tumours. Immunoelectrophoretic methods showed that the proteins present in an increased concentration in the tumor serum had mobilities corresponding to α_1 and α_2-globulins. ***P. N. Campbell, Barbara A. Kernot, and I. M. Roitt.*** *Biochemical Journal*, v. 71, no. 1, Jan. 1959, p. 155-159 + 1 plate.

4932* Brain Phospholipid Metabolism *in vivo*. *A. N. Davison and J. Dobbing.* *Biochemical Journal*, v. 71, no. 1, Jan. 1959, p. 10P.

4933* Systematic Fluctuations in the Cellular Protein, RNA and DNA During Growth of Mammalian Cell Cultures. ***Norman P. Salzman.*** *Biochimica et Biophysica Acta*, v. 31, no. 1, Jan. 1959, p. 158-163.

4934* Relation of Ribonucleic Acid to the Photosynthetic Apparatus in *Euglena gracilis*. The ribonucleic acids of green and etiolated cells show small but definite differences in their nucleotide distribution. The green organisms have a higher proportion of adenylic and uridylic acids and a lower content of cytidylic and guanylic acids. ***George Brawerman and Erwin Chargaff.*** *Biochimica et Biophysica Acta*, v. 31, no. 1, Jan. 1959, p. 172-177.

4935* Metabolic Pools and the Synthesis of Macromolecules. Two functionally distinct amino acid pools are found in *Candida utilis*: a concentrating pool and a conversion pool. The former accumulates exogenous amino acids within the cell to levels exceeding their concentration in the external medium. This pool is only evident when exogenous amino acids are present. Once concentrated, these amino acids may provide material for the conversion pool. Here amino acid interconversion occurs thereby furnishing the amino acids required for protein synthesis. ***Dean B. Cowie and Frank T. McClure.*** *Biochimica et Biophysica Acta*, v. 31, no. 1, Jan. 1959, p. 236-245.

4936* Inhibition by Cytotoxic Drugs of Bone Marrow Regeneration After Irradiation and Marrow Transplantation. The regenerating bone marrow, following irradiation and recolonization with donor marrow intravenously, proved to be markedly sensitive to the effects of cytotoxic drugs, A-methopterin, 6-mercaptopurine, azaserine, and the fluorinated pyrimidines all inhibited marrow regeneration in doses several times smaller than the dose that caused toxic marrow damage. The possible application of these findings to the testing of cytotoxic drugs is discussed. ***J. W. Hollingsworth.*** *Cancer Research*, v. 19, no. 2, Feb. 1959, p. 165-169.

4937* A Mechanism of Resistance to 8-Azaguanine. I. Microbiological Studies on the Metabolism of Purines and 8-Azapurines. High concentrations of 9-ethyl-8-azaguanine were without effect in inhibiting growth of S. *faecalis*, an organism the growth of which is inhibited by very low concentrations of 8-azaguanine. Growth of 8-azaguanine-resistant organisms was not inhibited by 8-azaguanosine. From these results it is concluded that, in order to become inhibitory, 8-azaguanine must first be metabolized to 8-azaguanylic acid, which may then exert its growth-inhibitory effect by interfering with nucleotide metabolism, by being incorporated into nucleic acids, or by forming a fraudulent co-factor. ***R. W. Brockman, Carolyn Sparks, Dorris J. Hutchison, and Howard E. Skipper.*** *Cancer Research*, v. 19, no. 2, Feb. 1959, p. 177-188 + 3 plates.

4938* Natural Agglutinins in Rat Sera Against Cells of Mouse Tumors Differing in Their Transplantability to Pretreated Rats. A rather high titer of natural agglutinins was found in sera of all normal rats of the same strain against the cells of homotransplantable mouse tumors, which could not grow progressively in rats pretreated with mouse tumors. A change of a strain specificity of a mouse tumor line was correlated with a change in its transplantability to pretreated rats, and this change was associated with a conspicuous rise in the intensity of the agglutination of the cells of such tumors by sera of untreated rats. ***M. Pikovski and M. Schlesinger.*** *Cancer Research*, v. 19, no. 2, Feb. 1959, p. 227-232.

4939* Some Systemic Effects of Toxohormone. The administration of an extract of the Walker carcinosarcoma 256 produced changes in normal rats similar to those found in rats bearing the Walker tumor. The alterations which occurred after a single or repeated injection of toxohormone were: anemia, decreased plasma iron, depressed activity of the liver and kidney catalase, increased weight of the liver, spleen, and adrenals, and thymus involution. The relationship of these findings to the concept of a cancer toxin was discussed. Plasma iron was found to be 250-500 times as sensitive to toxohormone as liver catalase and therefore may prove valuable in the testing for toxohormone activity. ***Ralph F. Kampschmidt, Mabelle E. Adams, and Thomas A. McCoy.*** *Cancer Research*, v. 19, no. 2, Feb. 1959, p. 236-239.

4940* Some Evidence Concerning the Mode of Binding of Histamine. ***Fred J. McIlreath, Jr.*** *Canadian Journal of Biochemistry and Physiology*, v. 37, Feb. 1959, p. 151-163.

4941* Symposium on Neurosecretion. Held in Kingston, Ontario in June 1958. Formal papers included: discussion of neurohypophyseal secretion; activation of ACTH release by such secretions; adrenergic mediators; and formation, storage, and release of acetylcholine at nerve endings. ***A. S. V. Burgen.*** *Canadian Journal of Biochemistry and Physiology*, v. 37, Feb. 1959, p. 307-308.

4942 Chemical Transformations by Microorganisms. Chemical anatomy of microorganisms, organic type reactions of microorganisms, and synthetic powers of microorganisms. ***Frank H. Stodola.*** 134 pp. 1958. John Wiley and Sons, New York. (QR84 St64c)

4943 The Chemistry of Insulin. Nobel Lecture. ***F. Sanger.*** *Chemistry & Industry*, 1959, no. 4, Jan. 24, p. 104-109.

4944* Mechanism of the Cancerostatic Action of 6-Azauracil and Its Riboside. 6-Azauracil and 6-azauracil riboside accumulate in cancerous tissues where they are converted into 6-azauracil riboside-5′-phosphate. After administration of the two substances to healthy and cancerous animals, certain nucleic acid precursors, in particular orotic acid and orotidine, are eliminated in the urine. ***V. Habermann and F. Sorm.*** *Collection of Czechoslovak Chemical Communications*, v. 23, no. 12, Dec. 1958, p. 2201-2206 + 1 plate.

4945* Presence of Particles Having the Appearance of Viruses in the Tumor Tissues of Mice Affected by Induced Leukemias. Three types of particles, already found in spontaneous leukemias, were observed under the electronic microscope. (*In French.*) Présence de particules d'aspect virusal dans les tissues tumoraux de souris atteintes de leucémies induites. ***Wilhelm Bernhard and Ludwik Gross.*** *Comptes Rendus Hebdomadaires des Séances de l'Académie des Sciences*, v. 248, no. 1, Jan. 5, 1959, p. 160-162 + 4 plates.

4946 Some Survival Aspects of Space Travel. Reliability and accuracy of high speed automatic control systems. Suitably linking the human operator to his "automatic" systems. Reconversion of liquid and food waste products to useful nutrients by using secondary living organisms. Temperature control and solar heat acceleration. Solar and cosmic radiation. Escape potential. ***A. M. Mayo.*** *Electronic Industries*, v. 18, Feb. 1959, p. 60-63.

4947 Researching Microwave Health Hazards. High-powered radar, radio and countermeasure transmitters now being designed, built and tested, present an element of hazard to health. ***Frank Leary.*** *Electronics*, v. 32, no. 8, Feb. 20, 1959, p. 49-53.

4948* Modification of the X-Irradiation Syndrome by Lycopene. Lycopene, injected intraperitoneally as a particulate suspension in irradiated mice, has a moderate curative action either when given before or shortly after the X-ray dose. ***A. Forssberg, Chr. Lingen, L. Ernster, and O. Lindberg.*** *Experimental Cell Research*, v. 16, no. 1, Jan. 1959, p. 7-14.

4949* Quantitative Changes in Rat Liver Mitochondria Following Whole Body Irradiation. Mitochondria are transiently damaged by irradiation *in vivo* but are soon reconstituted to reach pre-irradiation levels prior to the recovery of nuclear activities. ***P. P. Noyes and R. E. Smith.*** *Experimental Cell Research*, v. 16, no. 1, Jan. 1959, p. 15-23.

4950* The Culture of Mature Organs in a Synthetic Medium. ***O. A. Trowell.*** *Experimental Cell Research*, v. 16, no. 1, Jan. 1959, p. 118-147.

4951* A Comparison of the Relative Effectiveness of Radiations of Different Average Linear Energy Transfer on the Induction of Dominant and Recessive Lethals in Drosophila. ***C. W. Edington and M. L. Randolph.*** *Genetics*, v. 43, no. 5, Sept. 1958, p. 715-727.

4952* Protection Against Radiation by 5-Hydroxytryptamine. A discussion of the interaction of 5-hydroxytryptamine and reserpine and a determination of the most effective time for the action of one milligram per animal of 5-hydroxytryptamine, administered in connection with exposure of the whole body to a radiation of 810 r., and of the maximum effective concentration of same. *German Science Bulletin*, no. 34, Jan. 1959, p. 30-31.

4953 Short Distance Radio Telemetering of Physiological Information. A completely transistorized radio transmitter and a receiving system are described operating at 104 mc. The weight of the transmitter is under two pounds without the use of miniature parts. Design is for transmission of up to ten channels with bandwidths of 250 and 1000 cps. The channel reported has a carrier frequency of 2100 cps and was tested for EKG recording. Satisfactory calibrated records were obtained while walking and while on treadmill. ***H. G. Beenken and F. L. Dunn.*** *IRE Transactions on Medical Electronics*, PGME-12, Dec. 1958, p. 53-57. (TK1 In6.6m Vis.)

4954 Theory of Measurement of Blood Flow by Dye Dilution Technique. The mathematical procedure for handling the recirculation problem is described, and it is shown that, in general, sampling of concentration at a single point is not sufficient to uniquely determine both the volume and flow in a vascular bed. The more basic problem of synthesizing a mathematical model of the circulation is analyzed. A general probabilistic scheme for handling transport problems of this kind is outlined, and results obtained for exchange of labeled material between the vascular and extravascular fluid compartment are described. ***John L. Stephenson.*** *IRE Transactions on Medical Electronics*, PGME-12, Dec. 1958, p. 82-88. (TK1 In6.6m Vis.)

4955* The Fibrinogen Molecule: Its Size, Shape, and Mode of Polymerization. The shadow-cast bovine fibrinogen molecule consists of a linear array of 3 nodules held together by a very thin thread which is estimated to have a diameter of from 8 to 15 A, though it is not clearly resolved. The two end nodules are alike but the center one is slightly smaller. Measurements of shadow lengths indicate that nodule diameters are in the range 50 to 70 A. The length of the dried molecule is 475 ± 25 A. The intermediate polymers formed when fibrinogen is activated with thrombin were examined and found to be end-to-end aggregates of altered fibrinogen molecules which shrink in length during the process. Intermediate polymer lengths are from 1000 to 5000 A. ***Cecil E. Hall and Henry S. Slayter.*** *Journal of Biophysical and Biochemical Cytology*, v. 5, no. 1, Jan. 25, 1959, p. 11-16 + 1 plate.

4956* Heteromorphic Change of Adult Fibroblasts by Ribonucleoproteins. Cultures of subcutaneous areolar fibroblasts from adult rats, when confronted *in vitro* with microsomes from rat liver or kidney, are changed heteromorphically so as to resemble cultures of nervous tissue. Similar effects follow exposure to the deoxycholate-insoluble fraction of microsomes, and to purified RNA from rat liver or from yeast. An equivalent ribonucleoside mixture has no heteromorphic effect. The degree of heteromorphosis can be related quantitatively to the amount of RNA administered, up to a maximum of 150 γ per slide, above which toxicity intervenes. Ribonuclease destroys in considerable degree the effectiveness of the active agents. ***Helena H. Benitez, Margaret R. Murray, and Erwin Chargaff.*** *Journal of Biophysical and Biochemical Cytology*, v. 5, no. 1, Jan. 25, 1959, p. 25-34 + 4 plates.

4957* Correlation of Physical and Biological Properties of Mouse Mammary Tumor Agent. Filtration of milk from RIII high-breast-cancer mice through gradocol membranes with decreasing pore sizes indicated that a minimum of activity passed through intermediate pore sizes (100 to 160 mμ). Filtrates through smaller pores were significantly active. Milk treated with small doses of deuteron irradiation produced more tumors than the control, unirradiated milk; larger doses indicated a particle size much less than 100 mμ. Free diffusion experiments indicated that the activity was associated with particles of two different sizes. Altogether the data denoted the presence of a large agent about 100 mμ in diameter and a small agent 20 to 30 mμ in diameter or possibly smaller. Furthermore, the presence in the milk of an inhibitor 40 to 60 mμ is indicated by the results of all three approaches. ***Dan H. Moore, E. Y. Lasfargues, Margaret R. Murray, Cushman D. Haagensen, and E. C. Pollard.*** *Journal of Biophysical and Biochemical Cytology*, v. 5, no. 1, Jan. 25, 1959, p. 85-92 + 4 plates.

4958 Transformation of Organic Compounds by Microorganisms. Discusses the types of chemical reactions carried out by microörganisms, including oxidations, reductions, specific hydrolyses, decarboxylation, deamination, amination, phosphorylation, transfer reactions, racemization, dehydrations, demethylation, and condensations. ***D. Perlman.*** *Journal of Chemical Education*, v. 36, Feb. 1959, p. 60-63.

4959 Statistical Mechanics of Helix-Coil Transitions in Biological Macromolecules. Evaluates the complete partition function for a polypeptide system with the aid of either the method of Lagrangian multipliers or the method of steepest descents. When this is done, a transition from alpha helix to random coil is obtained as a result. ***J. H. Gibbs and E. A. DiMarzio.*** *Journal of Chemical Physics*, v. 30, Jan. 1959, p. 271-282.

4960* Oscillation of the Intraleucocytic Granules as a Criterion of Survival of the Leucocyte and of the Potency of Cytotoxic Agents. The leucocyte of the granular series that fails to develop oscillation of its granules when suspended in 0.2-0.4% NaCl is a dead leucocyte. Oscillation of the intracellular granules in hypotonic solution can therefore be used as a criterion of the cytotoxic action of drugs, antiseptics, antibiotics, etc., to which the leucocyte may be exposed. ***Joyce A. McLeod and J. W. McLeod.*** *Journal of Pathology and Bacteriology*, v. 77, no. 1, Jan. 1959, p. 219-230.

4961 Solution Properties of Desoxyribonucleic Acid (DNA). I. Hydrodynamic Behavior. II. Light Scattering. I. ***J. Hermans, Jr. and J. J. Hermans.*** II. ***J. Hermans, Jr.*** *Journal of Physical Chemistry*, v. 63, Feb. 1959, p. 170-178.

4962* Directly Observed Prolonged Tissue-Cultures. A tissue-culture method is described, which makes it possible to watch the cell development in the microscope even with an oil immersion, without destroying the cultures. At the same time it gives the possibility of changing the culture liquid, aseptic addition, enzymatic digestion, and fixation and coloring of the cultures directly in the culture flask. (*In French.*) Cultures de tissus prolongées à observation directs. ***C. Vago.*** *Mikroskopie*, v. 13, nos. 7/8, Dec. 1958, p. 246-250.

4963* On the Size of Genetic Determinants in *Pneumococcus* and the Nature of the Variables Involvd in Transformation. The activity of a sample of DNA depends on its ability to be absorbed on the surface of the bacterium, absorbed through the membrane, and incorporated into the genome, as well as on the number of markers which it contains. An equation has been derived which relates the rate of destruction of markers to their size, and this, combined with the kinetic equation for transformation, gives the transforming activity as a function of marker size. A large part, although not necessarily all, of the observed loss in transforming activity can be attributed to decreased absorption of DNA; the size of the genetic marker is small, possibly of the order of several nucleotides; there are probably two types of absorption site on the pneumococcal surface, one of which absorbs only DNA of molecular weight greater than about 2.2×10^6; a constant number of mols rather than a constant weight of DNA is probably bound by each type of site at saturation; the molar binding constant for DNA by bacterial sites is constant in the range studied below $M_n = 2.2 \times 10^6$; the probability of incorporation of each marker into the bacterial genome has a different dependence on molecular weight. ***Barbara H. Rosenberg, Francis M. Sirotnak, and Liebe F. Cavalieri.*** *National Academy of Sciences, Proceedings*, v. 45, Feb. 1959, p. 144-156.

4964* Electron-Spin Resonance Studies of Radiation Damage to Certain Lipids, Hormones, and Vitamins. ***Harvey N. Rexroad and Walter Gordy.*** *National Academy of Sciences, Proceedings*, v. 45, Feb. 1959, p. 256-269.

4965* Electron-Spin Resonance Studies of Radiation Damage to the Nucleic Acids and Their Constituents. ***Howard Shields and Walter Gordy.*** *National Academy of Sciences, Proceedings*, v. 45, Feb. 1959, p. 269-281.

4966 The Lymphocyte Problem. Nature, size, movement of lymphocytes, place of formation in vertebrates, lymphocyte formation in the thymus and lymphoid tissues, circulation, their possible defensive role by producing antibodies to foreign protein; high sensitiveness to radiation; the possibility for transfused marrow cells to colonize lymphoid tissues. Cellular migration streams in the normal animal. ***J. M. Yoffey.*** *Nature*, v. 183, Jan. 10, 1959, p. 76-78.

4967 Sparing Effect of Serum From Mice Treated With Endotoxin Upon Certain Murine Virus Diseases. More mice survived after receiving serum from endotoxin treated mice, heated or unheated, which suggested the presence in serum from mice treated with endotoxin of a substance which raises the resistance of mice to ectromelia virus. More mice survived after receiving serum from mice reacting to endotoxin, fresh or heated, than mice which received normal serum. Serum from rabbits reacting to endotoxin increases the resistance of mice to ectromelia. ***A. W. Gledhill.*** *Nature*, v. 183, Jan. 17, 1959, p. 185-186.

4968 Inhibition of Influenza Virus Multiplication With a Glucose Antimetabolite (2-deoxy-D-glucose). In the intact chick embryo, the synthesis of influenza virus is markedly inhibited by 2-deoxy-D-glucose. Ancillary studies with *in vitro* systems show this inhibition to be reversible with glucose and therefore not related to permanent host cell damage. ***Edwin D. Kilbourne.*** *Nature*, v. 183, Jan. 24, 1959, p. 271-272.

4969 Synthetic Activity of Polynucleotide Phosphorylase From Sperm. Pure enzyme was prepared from a polynucleotide phosphorylase isolated from the human sperm. Chromatograms of the enzymic reaction solutions were developed by the descending technique in two dimensions. The polynucleotides located were cut out and eluted. The ultraviolet spectrum, chemical identity, and concentration were studied. Homopolymers of adenylic, uridylic, guanylic, and cytidylic acid with several heteropolymers were found in the solutions. The enzymic activities of the polynucleotide phosphorylase provide a possible explanation of the differences in composition and structure of ribonucleic acids. ***Anwar A. Hakim.*** *Nature*, v. 183, Jan. 31, 1959, p. 334.

4970 Pattern of Synthesis of Deoxyribonucleic Acid in *Bacillus cereus* Growing Synchronously Out of Spores. ***I. Elizabeth Young and Philip C. Fitz-James.*** *Nature*, v. 183, Feb. 7, 1959, p. 372-373.

4971 The Myoglobin Molecule. ***Helen Scouloudi.*** *Nature*, v. 183, Feb. 7, 1959, p. 374-376.

4972 Juvenile Hormone in Thymus, Human Placenta, and Other Mammalian Organs. ***Carroll M. Williams, Lynn V. Moorhead, and Jean F. Pulis.*** *Nature*, v. 183, Feb. 7, 1959, p. 405.

4973 Micro-Electrode Penetration of Ascites Tumour Cells. ***B. M. Johnstone.*** *Nature*, v. 183, Feb. 7, 1959, p. 411.

4974 'Dual Antagonists'; Alkyl N-(*bis*-(ethyl-enimido) phosphoro)-carbamates: a New Series of Anti-Tumour Agents. ***Thomas J. Bardos and Zinon B. Papanastassiou.*** *Nature*, v. 183, Feb. 7, 1959, p. 399-400.

4975* General Mathematical Principles in Biology. A survey of the progress made in using the mathematical approach, in biological questions, especially that based on the unity of the organism, and of the organic world, as a whole. The set of all subproperties characterizing a given higher organism can be mapped in a many-to-one manner onto the set of all subproperties characterizing a lower organism. In this mapping certain basic relations between the different properties are preserved. ***N. Rashevsky.*** *New York Academy of Sciences, Transactions*, v. 21, no. 2, Dec. 1958, p. 128-134.

4976* The Cytopathology of Virus Infection. List of papers presented at the Section of Biology of the New York Academy of Sciences, November, 1958. Virus multiplication, double infection, propagation and relationship with inclusion bodies, as well as fluorescent and electron microscopy of infected cells, were among the subjects treated. *New York Academy of Sciences, Transactions*, v. 21, no. 2, Dec. 1958, p. 159-161.

4977 Physiology of Fungi. A comprehensive text covering: cultivation and growth, composition of fungus cells, carbon nutrition and metabolism, respiration, nitrogen and inorganic nutrition and metabolism, vitamin requirements, reproduction, and the action of physical and chemical agents. ***Vincent W. Cochrane.*** 524 pp. 1958. John Wiley & Sons, New York. (QK601 C64p)

4978* Problems of Medicine and Biology. A review of the Soviet reports on medical radiology and radiobiology, presented at the Second Geneva Conference on the Peaceful Use of Atomic Energy. The medical reports could be divided in five groups related to the biological action of irradiation and isotopes on human and animal organisms; the use of isotopes in the diagnosis of human and animal diseases; safety techniques; the elimination of radioactive waste; using isotopes in agriculture. (*In Russian.*) Voprosy meditsiny i biologii. ***F. G. Krotkov.*** *Priroda*, v. 48, no. 1, Jan. 1959, p. 108-111.

4979* 70 Newly Recognized Viruses in Man. Fifteen clinically and epidemiologically distinguishable illness entities were

attributable to the newly recognized viruses. New human myxoviruses, with properties differentiating them from the older, animal varieties, were listed. Studies of the high prevalence of viral illnesses in children suggest that an effective vaccine, requiring perhaps as many as 25 separate viral antigens, would probably be incorporated in pediatric immunization schedules. The relationship between the new viruses and noninfectious diseases and also human cancer was examined. ***Robert J. Huebner.*** *Public Health Reports*, v. 74, Jan. 1959, p. 6-12.

4980 Crystal Fluorescence of Carcinogens and Related Organic Compounds. The crystalline fluorescence spectra of 41 organic compounds, including 29 known carcinogens, have been observed, when excited by 254 mμ radiation. In the 1:2-benzanthracene derivatives, a sequence of spectral types is observed, ranging from type A, with a vibrational structure similar to the spectrum of the parent compound, to type *E*, with a single broad, diffuse band and a major bathochromic shift. The effect is attributed to molecular interaction in the crystal. ***J. B. Birks and A. J. W. Cameron.*** *Royal Society, Proceedings*, v. 249, ser. A, Jan. 13, 1959, p. 297-317.

4981* Immunological Status and Longevity of Radiation-Chimaeras. Concludes that in homologous chimaeras the host is tolerant of the donated grafts of myeloid tissue; that if the histoincompatibility between graft and host is marked, the graft may react against the host to produce 'secondary disease'; and that, if the histoincompatibility is slight or if immature myeloid tissue is given, 'secondary disease' is attenuated. The roles of 'partial tolerance', 'immunological paralysis' and 'enhancement' of the graft versus host reaction are discussed. ***D. W. H. Barnes and J. F. Loutit.*** *Royal Society, Proceedings*, v. 150, ser. B, Jan. 27, 1959, p. 131-146.

4982 Maximum Permissible Body Burden of Strontium-90. The permissible body burden of Sr^{90} is discussed with respect to the mode of intake. It appears that the maximum permissible load may depend on the type of exposure, acute or chronic, the acute being the more serious. ***R. Björnerstedt and A Engström.*** *Science*, v. 129, Feb. 6, 1959, p. 327-328.

4983 Second Spectroscopically Abnormal Methemoglobin Associated With Hereditary Cyanosis. Suggests that the abnormal properties which characterize the acidic methemoglobin derivatives result from a crevice configuration of the heme, with two Fe-protein bonds. ***Park S. Gerald and Philip George.*** *Science*, v. 129, Feb. 13, 1959, p. 393-394.

4984* Bibliography of Space Medicine. Subject categories include sealed cabin problems, acceleration/deceleration, fractional and zero gravity, cosmic radiation, nutrition in space flight, survival problems, psychologic and social problems, ground crew problems, extraterrestrial aspects, and other bibliographies. ***Charles A. Roos.*** *U. S. Armed Forces Medical Journal*, v. 10, Feb. 1959, p. 172-217.

4985 Report of the Joint Program of Studies on the Decontamination of Radioactive Waters. Consideration is given to probable sources of radioactive contamination in the environment and to the potential health hazard of such contamination in drinking water supplies. Among the sources discussed are the nuclear bomb, the atomic installations, and other users of radioisotopes. Experimental results indicate the extent to which natural agents (physical, chemical, and biological) may concentrate radioactive materials, thus removing them from the waste streams. The water decontamination findings—laboratory studies, pilot-plant studies, and tests of emergency water treatment units—are discussed in relation to the treatment process involved. ***Robert A. Taft.*** *U. S. Atomic Energy Commission, ORNL-2557*, Feb. 9, 1959, 65 pp. (UF767 U3o Contin.)

4986 Proceedings of the Inter-American Symposium on the Peaceful Application of Nuclear Energy. Papers presented at the meeting held in May, 1957 at the Brookhaven Laboratory. The folowing are some of the subjects treated; biological effects of radiation, theory of tracer techniques, teletherapy, nuclear reactor as an instrument in medical therapy, isotopes in hematologic research or in plant biochemistry, radiation in food and drug sterilization and preservation. *U. S. Atomic Energy Commission, TID-7554*, (Book 2), May 1957, 246 pp. (UF767 Un3ti Contin.)

4987 Biology and Ultracentrifugal Methodology of the High-Density Lipoproteins and the Proteins of Human Serum. A randomly collected population consisting of 2297 clinically healthy humans (1961 males and 336 females) constituted the subjects used in this study. Measurements were made on the concentrations of the three high-density classes of lipoproteins (HDL_1, of hydrated density 1.045 g/ml; HDL_2, 1.075 g/ml; and HDL_3, 1.145 g/ml) and of the three protein classes (F_1, a macroglobulin of S rate 19; P_2, the gamma globulin of S rate 6; and P_3, the albumin of S rate 4). The Pearson product-moment correlations were calculated, for each group, for each component measured with each other kind of macromolecule measured, including the low-density lipoproteins. The results of the calculations of distributions and correlations are discussed, and some conclusions are drawn from the findings. ***Oliver Francis de Lalla.*** *U. S. Atomic Energy Commission, UCRL-8350*, Nov. 25, 1958, 91 pp. (UF767 U3u Contin.)

4988 Studies on Aerosols. Summarizes published and unpublished experimental and technical data on liquid and solid aerosols (inert, pharmacological or toxic). Emphasis is given to the production, measurement and biological importance of submicronic and submicroscopic particles, and to the physiological and pathological effects caused by their retention in the respiratory tract. The bibliography consists of more than three thousand references. ***L. Dautrebande.*** *U. S. Atomic Energy Commission, UR-530*, Oct. 1, 1958, 590 pp. (UF767 Un3.1ru Contin.)

4989* Immunoelectrophoretic Characteristics of Normal Mouse Serums as a Basis for Studying Pathological Changes in Serums of Mice Carrying Transplantable Malignant Growths. ***J. Heremans, J. Clausen, M. Th. Heremans, and R. Rask-Nielsen.*** *U. S. National Cancer Institute, Journal*, v. 22, no. 1, Jan. 1959, p. 45-56.

4990* Quantitative Biological Experimentation in the Virus and Cancer Fields. ***W. Ray Bryan.*** *U. S. National Cancer Institute, Journal*, v. 22, no. 1, Jan. 1959, p. 129-159.

4991* Smoking and Lung Cancer: Recent Evidence and a Discussion of Some Questions. ***Jerome Cornfield, et al.*** *U. S. National Cancer Institute, Journal*, v. 22, no. 1, Jan. 1959, p. 173-203.

4992* Inhibition of Influenza Virus Multiplication in Tissue Culture by Structural Analogs of Amino Acids. Norleucine, β-phenylserine, and canavanine flavianate inhibited the growth of influenza A and B viruses in tissue culture. Canavanine was a mild inhibitor, while flavianic acid acted as a virucide. Canavanine flavianate apparently combined these two characteristics into a chemotherapeutic agent superior to either canavanine or flavianic acid alone. Allylglycine and S-ethylcysteine inhibited the growth of the influenza A virus in embryonic chick lung tissue culture. None of the compounds prolonged significantly the life of mice infected with the virus. ***W. D. Kundin, Mary Louise Robbins, and Paul K. Smith.*** *Virology*, v. 7, no. 1, Jan. 1959, p. 1-27.

4993* Biological Peculiarities of Diphtheric Bacteriophages. II. The Adsorptive Property of Bacteriophages. The Property of Secondary Phage-Resistant Variants of *Bacillus diphtheria*. The Antigenic Properties of Phages. (*In Russian.*) Biologicheskie osobennosti difteriĭnykh bakteriofagov. II. Adsorbtsionnaia sposobnost' bakteriofagov. Svoĭstva vtorichnykh fagoustoĭchivykh variantov difteriĭnoĭ palochki Antigennye svoĭstva fagov. ***V. V. Pospelova.*** *Zhurnal Mikrobiologii, Epidemiologii, i Immunobiologii*, v. 29, no. 11, Nov. 1958, p. 90-95.

4994* Leukolytic Properties of the Blood Serum as One of the Indices of Immunological Reactivity of the Body. (*In Russian.*) Leĭkotsitoliticheskie svoĭstva syvorotki krovi kak odin iz pokazateleĭ immunologicheskoĭ reaktivnosti organizma. ***N. I. Kruglaia.*** *Zhurnal Mikrobiologii, Epidemiologii, i Immunobiologii*, v. 30, no. 1, Jan. 1959, p. 29-33.

4995* Certain Immunological Mechanisms of Self-Protection of the Body Against the Action of Ionizing Radiation. Mice, subjected to a twice repeated X-radiation (150 r), were 1.7 times more resistant than the control subjects, to the

toxin of *B. perfringens* and 1.24 times resistant to the dysenteric toxin. In animals subjected to a once repeated X-radiation (150 r), the intensity of bacteremia and the penetration of bacteria into the internal organs were much lower than in the controls. (*In Russian.*) O nekotorykh immunologicheskikh mekhanizmakh samozashchity organizma ot deĭstviia ioniziruiushcheĭ radiatsii. ***P. N. Kiselev and V. A. Semina.*** *Zhurnal Mikrobiologii, Epidemiologii, i Immunobiologii*, v. 30, no. 1, Jan. 1959, p. 44-50.

See also: **6016** (mold nutrients).

CERAMICS AND CONCRETE

4996 Release of Alkalies by Sands and Admixtures in Portland Cement Mortars. Mortar bars leached with water were used to study the ability of admixtures and aggregates to release alkalies to the liquid phase of a hardened cement paste and also the ability of admixtures to combine with alkalies in a mortar. ***W. C. Hansen.*** *ASTM Bulletin*, no. 236, Feb. 1959, p. 35-38.

4997 An Instrument for the Measurement of Pore-Size Distribution by Mercury Penetration. Penetration is measured by direct volumetric readings made through transparent walls of a pressure chamber on the calibrated stem of a penetrometer containing the sample within the instrument. Controlled stepwise pressuring is obtained by means of a hand-operated pressure generator, which is part of the self-contained hydraulic system of the instrument, operable without auxiliary apparatus other than analytical balance and vacuum pump. ***N. M. Winslow and J. J. Shapiro.*** *ASTM Bulletin*, no. 236, Feb. 1959, p. 39-44.

4998 Tunnel Kiln Temperature Measurement. Investigation was made by means of four Chromel-Alumel thermocouples connected to a multi-point recording potentiometer by 300 ft. of extension wire. Thermocouples were attached to a kiln car and moved through the kiln. Record showed errors in the time-temperature curve. Several changes in kiln operation were made. ***R. H. Kennedy.*** *American Ceramic Society Bulletin*, v. 38, Feb. 1959, p. 45-47.

4999 Aluminum Nitride, a Refractory for Aluminum to 2000 C. A method of preparing high-purity AlN by striking a d.c. arc between two high-purity aluminum electrodes in a nitrogen atmosphere is described. A refractory having excellent strength and low porosity was achieved by hydrostatic pressing and firing at high temperatures. The mechanical, electrical, thermal, and chemical properties of the refractory are discussed. ***George Long and L. M. Foster.*** *American Ceramic Society, Journal*, v. 42, Feb. 1959, p. 53-59.

5000 Zeta Potentials in Relation to Rheological Properties of Oxide Slips. The characteristic minimum which occurs in the apparent viscosity-pH curves for oxide slips is explained in terms of the zeta potential of the dispersed oxide. The model adopted also explains a number of other features of the rheological behavior of oxide slips. ***P. J. Anderson and P. Murray.*** *American Ceramic Society, Journal*, v. 42, Feb. 1959, p. 70-74.

5001 Preliminary Study of the Phase Equilibria Diagram of ThO_2-SiO_2. A preliminary study of the system ThO_2-SiO_2 supported the premise that the system CaF_2-BeF_2 is a model for this silicate system. The only compound present was the monoclinic form of $ThSiO_4$ (huttonite), which melted incongruently to ThO_2 and liquid at 1975 ± 10 C. No solid-solution areas were observed. The quenching samples were fired in a modified oxygen-acetylene furnace which was developed to insure accurate temperature readings and to retain the effects of heating the samples in air. ***L. A. Harris.*** *American Ceramic Society, Journal*, v. 42, Feb. 1959, p. 74-77.

5002 Studies in Lithium Oxide Systems: III. Liquid Immiscibility in the System Li_2O-B_2O_3-SiO_2. ***B. S. R. Sastry and F. A. Hummel.*** *American Ceramic Society, Journal*, v. 42, Feb. 1959, p. 81-88.

5003 Effect of Minor Additions on Sintering of MgO. Fourteen selected metal ions were added to magnesium basic carbonate, and the MgO obtained after calcining was fired at various temperatures to determine the effect of the additives on the sintering behavior. The magnesia without additives showed rapid increase in density with firing temperature near 1200 C. The majority of the additives caused increased density at a given firing treatment, but some were without effect and one (Cr) dramatically inhibited sintering in certain percentages. ***G. K. Layden and M. C. McQuarrie.*** *American Ceramic Society, Journal*, v. 42, Feb. 1959, p. 89-92.

5004 Mixing and Flow in Glass Tanks. Mixing influences that are effective during the flow of glass through continuous tanks are classified. Common experimental techniques for evaluating these influences are compared. A multi-cell model is used to describe flow behavior in the absence of mixing from transfer flow. Laminar transfer flow in a glass tank is evaluated by considering flow through an open channel with a vertical viscosity gradient. ***Alfred R. Cooper, Jr.*** *American Ceramic Society, Journal*, v. 42, Feb. 1959, p. 93-101.

5005* Surface Tension and Contact Angles in Some Liquid Metal-Solid Ceramic Systems at Elevated Temperatures. Surface tension and its temperature dependence were determined for pure liquid Fe, Cu, Co, Ni, and Sn, and for Fe-C, Co-C, and Ni-C alloys. The surface tension and wetting behavior of Sn and Sn-Ti alloys on Al_2O_3, Si_3N_4, $MoSi_2$, and SiC, as well as the behavior of Ti-containing Ni alloys on Al_2O_3 were determined over a wide temperature range. Some limits for the solid-surface energies were calculated from liquid surface tension and wetting behavior. ***B. C. Allen and W. D. Kingery.*** *American Institute of Mining, Metallurgical, and Petroleum Engineers, Transactions, Metallurgical Society*, v. 215, no. 1, Feb. 1959, p. 30-37.

5006 The Structure of Liquid Silicates. II. Molar Volumes and Expansivities. Measurements have been made of the densities of liquid silicates in the MgO + SiO_2; CaO + SiO_2; SrO + SiO_2 and BaO + SiO_2 systems in the temperature range 1600-1950 C with an accuracy of ± 0.2%. An Archimedean method was used in conjunction with a graphite resistor furnace. ***J. W. Tomlinson, M. S. R. Heynes, and J. O'M. Bockris.*** *Faraday Society, Transactions*, v. 54, Dec. 1958, p. 1822-1833.

5007 Some Aspects of Heat Recovery in Glass Furnaces. Effects of heat recovery; heat recovery systems; conditions for application; features and advantages; applications. ***H. B. Stewart.*** *Glass Industry*, v. 40, Feb. 1959, p. 77 + 5 pages.

5008* Determination of the Grinding Balls Wearing Rate in Ball Mills by Means of Radioisotopes. (*In Czech.*) Stanovení opotřebení melcích koulí v kuželových mlýnech pomocí radioisotopů. ***František Štorek, Jaroslav Vršek, and Jiří Likeš.*** *Hutnické Listy*, v. 14, no. 1, Jan. 1959, p. 89-92.

5009 Some Plastic Properties of Pastes Made From Hydrated Dolomitic and High-Calcium Limes. A study of particle-size distribution data and X-ray diffraction analysis show that soaking increases plasticity. The increase is correlated with high $Mg(OH)_2$ content and high relative amounts of fine particles. ***D. L. Deadmore and J. S. Machin.*** *Illinois State Geological Survey, Circular* 261, 1958, 9 pp. (TN21 IL6.7c Vis.)

5010 Development of Ultra Low Loss Wollastonite Ceramic Insulation. Body preparation and testing; wollastonite-barium carbonate-No. 4 ball clay bodies and clay-lead borate bodies. Ultrafine wollastonite reduces loss factor of body; partial substitution of talc aids in fabrication. Evaluation of high frequency loss qualities. ***Barlane R. Eichbaum.*** *Insulation*, v. 5, Feb. 1959, p. 19-24.

5011* Some Data on the Properties of Cemented Carbides With Uneven Distribution of the Cementing Phase. The main alloy investigated was WC-6% Co (VK6), made from VK2 alloy (containing 2% Co) with addition of pure Co or VK20 alloy (containing 20% Co). The possibility is shown of increasing the strength of hard metals (to 200-220 kg./mm.^{2} for fine-grained VK6) without decreasing the wear resistance, by a controlled non-uniform distribution of the Co. Reduction in strength is caused by the presence of small quantities of

finely dispersed WC formed during hot pressing. The dependence of the strength of the alloy, with an uneven Co distribution, on the concentration of Co was investigated. With increase of Co content from 4.5 to 6.2%, the bending strength increases. (*In Russian.*) Nekotorye dannye o svoistvakh tverdykh splavov s neravnomernym raspredeleniem tsementiruiushchei fazy. ***K. A. Bystrova and V. F. Funke.*** *Izvestiia Akademii Nauk SSSR, Otdelenie Tekhnicheskikh Nauk*, no. 6, June 1958, p. 37-41.

5012 High-Temperature Mechanical Properties of Graphite. I. Creep in Compression. II. Creep in Tension. Measurements were made on the steady-state rates of creep in the temperature range 2270 to 2780° K. I. ***Paul Wagner and Allen R. Driesner.*** II. ***Paul Wagner, Allen R. Driesner, and Larry A. Haskin.*** *Journal of Applied Physics*, v. 30, Feb. 1959, p. 148-154.

5013 Domain Wall Motion and Ferrimagnetic Resonance in a Manganese Ferrite. From a single crystal of manganese ferrite, specimen cores were cut which are capable of supporting single domain walls. These cores have been proportioned in two ways, one favoring a movable (110) wall, the other favoring a wall system perpendicular to the (110) plane. The basic experiment consists in applying rectangular current pulses to a winding, and observing the rate of change of flux as presented by the voltage in another winding. At low driving fields, the wall, once torn free of the surface, moves through the crystal at a velocity proportional to the applied field less an internal coercive force. At high fields the pulse shapes indicate complex domain structure. Ferrimagnetic resonance experiments have also been performed on samples cut from the same crystal, and the results of these are given. It is particularly interesting to compare the loss parameter for the equation of motion which we derive from the resonance experiments with that obtained from the wall motion experiment. ***J. F. Dillon, Jr. and H. E. Earl, Jr.*** *Journal of Applied Physics*, v. 30, Feb. 1959, p. 202-213.

5014 Domain Behavior in Some Transparent Magnetic Oxides. Magnetic domains were observed by means of the Faraday effect, and by the Bitter technique in a number of compounds having the spinel, magnetoplumbite, and perovskite-like structures. The latter compounds are orthorhombic and have the general formula $MFeO_3$ where M is Y, Nd, Sm, Eu, Gd, Tb, Dy, Ho, Er, Tm, Yb, or Lu. Domain boundaries in these compounds move for fields less than one oersted, and after saturation, crystals as large as (approx. 0.2 x 0.2 x 0.1 in.) remain single domains. Fields of 2500 oersteds are required to reverse the magnetization in the single domain crystals. Reversal occurs by nucleation and growth of a reverse domain. This is evident from the unusual torque curves. The fact that domain walls occur and move in such weak fields in these compounds indicates that the slight or parasitic magnetization is a uniform body property of the crystals. The parasitic magnetization of these compounds was determined from torque measurements. These crystals are well suited for light modulators because a uniaxial anisotropy holds the magnetization vectors normal to the large surfaces of thin flat crystals and weak fields produce changes in magnetization. Absorption coefficients were measured for some compounds for radiation having wavelengths from 0.6μ to 13μ. Thin sections were found to be transparent to light at the red end of the visible spectrum. The Faraday rotation was measured for $Li_{0.5}Fe_{2.5}O_4$, $MgFe_2O_4$, $YFeO_3$, and $PbFe_{11}Al_1O_{19}$. ***R. C. Sherwood, J. P. Remeika, and H. J. Williams.*** *Journal of Applied Physics*, v. 30, Feb. 1959, p. 217-225.

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See also: **5027** (concrete setting time control); **5055** (size and costs of filter presses); **5442** (thermal conductivity of SiO_2); **5596** (measuring shear modulus of concrete); **5600** (thermal stresses in design).

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5103 Spectrographic Determination of Aluminum, Iron, Potassium, and Silicon in Tungstic Oxide. Method uses a powder-pellet spark technique for the Al, Fe, and Si determinations, and a high voltage alternating current arc method for K. ***Thomas J. Veleker and Rudolph Dyck.*** *Analytical Chemistry*, v. 31, Mar. 1959, p. 387-390.

5104 Spectrographic Analysis of Tungsten Metal Powder. ***Rudolph Dyck and Thomas J. Veleker.*** *Analytical Chemistry*, v. 31, Mar. 1959, p. 390-392.

5105 Microdetermination of Water by Titration With Fischer Reagent. Compact apparatus and convenient procedure developed for direct microtitration of 0.01 to 3 mg. of water with Fischer reagent. ***E. L. Bastin, Herbert Siegel, and A. B. Bullock.*** *Analytical Chemistry*, v. 31, Mar. 1959, p. 467-473.

5106 High Temperature Gas Chromatography of Aromatic Hydrocarbons. Gas chromatograph capable of successful operation at temperatures up to at least 445 C has been evaluated. ***R. A. Baxter and R. T. Keen.*** *Analytical Chemistry*, v. 31, Mar. 1959, p. 475-476.

5107* Determination of Small Cobalt Contents in Ores, Pig Iron and Steels. The knowledge of the Co content of structural parts for reactor plants, which are exposed to heavy neutron irradiation, is of great interest. A photometric procedure is described, which gives very exact values. (*In German.*) Die Bestimmung kleiner Kobalt-Gehalte in Erzen, Roheisen und Stählen. ***G. Graue, S. Eckhard, and W. Gradtke.*** *Angewandte Chemie*, v. 71, no. 1, Jan. 7, 1959, p. 28-30.

5108* The Coulometric Determination of Oxygen in Steel According to the Melting-Extraction Process in a Flow of Argon. The specimen was degased not in vacuum but in an argon flow and its weight reduced to 0.5 g. The carbon monoxide was changed into carbon dioxide and coulometrically titrated. Examination of 180 specimens could be made in 24 hours. (*In German.*) Die coulometrische Bestimmung des Sauerstoffs in Stahl nach dem Schmelzextraktions-Verfahren im Argonstrom. ***Karl Abresch and Helmut Lemm.*** *Archiv für das Eisenhüttenwesen*, v. 30, no. 1, Jan. 1959, p. 1-6.

5109 The Chromatography of Gases and Vapours. VI. Use of the Stearates of Bivalent Manganese, Cobalt, Nickel, Copper, and Zinc as Column Liquids in Gas Chromatography. ***D. W. Barber, C. S. G. Phillips, G. F. Tusa, and A. Verdin.*** *Chemical Society, Journal*, 1959, Jan., p. 18-24.

5110 Determination of Argon and Oxygen by Gas Chromatography. Argon determined quantitatively in the presence of oxygen using the technique of gas-solid chromatography alone, at normal laboratory temperatures. ***G. S. Vizard and A. Wynne.*** *Chemistry & Industry*, 1959, no. 6, Feb. 7, p. 196-197.

5111* Determination of Magnesium in Slags and Scoria by Flame Spectrophotometry. Determination in the Mg line 2852.1Å. Requires separation of Si, but no separation of oxides. Absolute error is ± 0.2%. (*In French.*) Dosage du magnésium dans les laitiers et scories par spectrophotométrie de flamme. ***J. Coulombeau and M. Maire.*** *Chimie Analytique*, v. 41, Jan. 1959, p. 3-11.

5112 Correlation Between Physical Constants and Chemical Structure. Graphical Statistical Methods of Identification of Mineral and Fatty Oils, Glass, Silicones, and Catalysts. The methods discussed may assist in gaining more insight into many natural products handled in industry and products prepared in factories. The applications of these methods are numerous; the purpose of this treatise is to enable everybody to become acquainted with them. The introduction of the kinematic viscosity has been proved to be of high value for the investigation and characterization of mineral oils; it can replace in many cases the determination of the average molecular weight which now can be predicted. ***H. I. Waterman, C. Boelhouwer, and J. Cornelissen.*** 120 pp. 1958. Elsevier, New York. (TP691 W31c)

5113 Rapid Quantitative Methods for the Determination of Brighteners, Levellers and Anti-Pitting Agents in Nickel Electroplating Baths. Metal-ion additions can often be determined rapidly and accurately enough from the bath by direct polarography. ***K. Szmidt, T. Zak, and Zb. Kwiatkowski.*** *Institute of Metal Finishing, Transactions*, v. 36, pt. 1, Autumn 1958, p. 17-21.

5114 The Rapid Determination of Beryllium Oxide in Beryllium Metal. A rapid method of determining beryllium oxide in beryllium metal is presented. Samples of vacuum-cast or thermal-reduction metal powder or fine chips are dissolved in a methanol-bromine solution. Dissolution of resistant particles is completed by a methanol-hydrochloric acid solution. Electrolytic metal samples require a preliminary heat treatment before dissolution. Beryllium oxide in the undissolved residue is determined colorimetrically or volumetrically. Conditions were chosen to yield the same results as those obtained with the hydrogen chloride volatilization method. ***A. R. Eberle and M. W. Lerner.*** *Metallurgia*, v. 59, Jan. 1959, p. 49-52.

5115 The Determination of Cadmium in Zinc Anodes. The cadmium, along with an appreciable amount of zinc, is removed as sulphide from sulfuric acid solution in a closed flask. The zinc is then removed as ammonium zinc phosphate and the cadmium in the filtrate is determined colorimetrically as the sulfide. ***W. C. G. Wheeler and D. Durant.*** *Metallurgia*, v. 59, Jan. 1959, p. 53-54.

5116 A Two-Dimensional Paper Chromatographic Method Combining Ion-Exchange and Partition Techniques. New approach to paper chromatography comes as a result of the development of new ion-exchange materials prepared by introducing acidic or basic groups into the cellulose molecule. ***C. S. Knight.*** *Nature*, v. 183, Jan. 17, 1959, p. 165-167.

5117 Circular Gas Chromatograph. On a preparatory scale, use of the circular arrangement conserves solid support, liquid phase, carrier gas, and the energy required for thermostatic control. ***Roger S. Porter and Julian F. Johnson.*** *Nature*, v. 183, Feb. 7, 1959, p. 391-392.

5118* Separate Determination of Niobium and Tantalum in Special Steels Using Photometric Methods. Elimination and purification of earth acids. Determination of Nb by H_2O_2 and of Ta by pyrogallic acid. Investigation of alloyed steels containing Nb and Ta. Re-examination of Nb contents by hydroquinone process. Comparison of Nb and Ta conditions found by calculation of ferrous alloy contents and of those found by photometric determination. (*In German.*) Getrennte Bestimmung von Niob und Tantal in Sonderstählen mit Hilfe photometrischer Verfahren. ***Eberhard Grossfuss.*** *Neue Hütte*, v. 3, Dec. 1958, p. 753-757.

5119* Thermochemical Titrations. Review of thermoanalytical titrimetry. ***Joseph Jordan.*** *Record of Chemical Progress*, v. 19 no. 4, 1958, p. 193-213.

5120* Titrimetric Determination of Aluminium With Ethylenediaminetetra-Acetic Acid in the Presence of Iron, Copper, Titanium, Manganese, Calcium, Magnesium, and Phosphate. A rapid and accurate method for 5 to 15 mg samples. ***Ch. Cimerman, A. Alon, and J. Mashall.*** *Talanta*, v. 1, no. 4, Nov. 1958, p. 314-328.

5121* The Separation and Determination of Niobium and Tantalum by Partition Chromatography. Mixed methyl isobutyl ketone and hydrofluoric acid was used as solvent and the metals were detected by means of 8-hydroxyquinoline. ***Ian A. P. Scott and Robert J. Magee.*** *Talanta*, v. 1, no. 4, Nov. 1958, p. 329-333.

5122* Determination of Hydrazine and Hydrazine Derivatives Using Bromine Monochloride as Standard Solution. Titration values are not affected by the degree of acidification or by the nature of the acid used. ***E. Schulek and K. Burger.*** *Talanta*, v. 1, no. 4, Nov. 1958, p. 344-350.

5123* The Quantitative Determination of Fission and Nuclear Reaction Products. Defines the terms "per cent atom burn-up" and "per cent atoms consumed". Radiochemical and analytical methods which have been adapted and developed especially for this type of analysis are discussed. ***C. E. Crouthamel, Robert Heinrich, and Christopher Gatrousis.*** *Talanta*, v. 1, no. 4, Nov. 1958, p. 396-407 + 1 plate.

5124* The Determination of Metals in Organic Compounds by the Closed Flask Method. Method was used with Zn, Cd, Mg, B, and As. ***R. Belcher, A. M. G. MacDonald, and T. S. West.*** *Talanta*, v. 1, no. 4, Nov. 1958, p. 408-410.

5125* Analysis of Chlorophenolics in Soaps and Soap Based Preparations by an Ion-Exchange Technique. ***Robert Suffis and Donald E. Dean.*** *Toilet Goods Association, Proceedings of the Scientific Section*, no. 30, Dec. 1958, p. 13-14.

5126 A Spot Test Procedure for Iron and Copper Inclusions in Aluminum Cans. Method described here is limited to the detection of only Fe and Cu, but it may be adapted to analyzing for any elements which form colored complexes. The basis of the procedure for ions other than Cu and Fe is the same, but different indicators are used. ***W. E. Stavig.*** *U. S. Atomic Energy Commission, HW-57485*, Nov. 17, 1958, 10 pp. (UF767 Un3.1hw Contin.)

5127 Determination of Silver, Cadmium, Indium, and Tin in Silver-Base Alloys. A polarographic method. ***D. P. Stricos and J. T. Porter, II.*** *U. S. Atomic Energy Commission, KAPL-1911*, July 17, 1958, 8 pp. (UF767 Un3.1ka Contin.)

5128 The Total Assay of High Purity Niobium Metal by Differential Spectrophotometry. A method has been developed to determine the total Nb content of high purity Nb metal. It covers a concentration range of 92.3 to 100.0% Nb. The relative standard deviation of the method is about ± 0.1%. ***R. O. Backer, V. R. Wiederkehr, and G. W. Goward.*** *U. S. Atomic Energy Commission, WAPD-204*, Sept. 1958, 7 pp. (UF767 Un3.1wa Contin.)

5129* A Contribution to the Analysis of Polycyclic Aromatic Hydrocarbons in the Exhaust Gases of Diesel Motors. An analysis of the soot deposited by exhaust gas revealed the presence of polynuclear aromatic compounds such as anthracene, pyrene, 3,4-benzopyrene, 1,12-benzoperylene, fluoranthene, and 11,12-benzofluoranthene. The analysis resembled that of 3,4-benzopyrene in diesel soot, except for some important variants. A portion of the exhaust gases was conducted at the rate of 50 to 100 l. per min. onto a filter impregnated with silicone oil. The extracts obtained were subjected to a paper chromatographic examination after separation on an Al_2O_3 column. The most favorable concentration for paper chromatography was found to be $1\text{-}2 \cdot 10^{6}$ g. per component. The Rf values of each substance varied according to the concentration and the size of the paper stain. There was also an effect of the depth of immersion of the chromatographic paper into the solvent, so that this depth and the concentration of the substances tested should be maintained as constant as possible during the analysis. (*In German.*) Beitrag zur Analyse polycyclischer aromatischer Kohlenwasserstoffe in den Abgasen von Dieselmotoren. ***A. Reuter, K. O. Johne, and J. Lieb.*** *Zeitschrift für Analytische Chemie*, v. 164, no. 3, 1958, p. 335-337.

5130* Colorimetric Determination of Tantalum in the Presence of Niobium. (*In German.*) Colorimetrische Bestim-

mung des Tantals in Gegenwart von Niob. ***G. Popa, D. Negoiu, and Gh. Baiulescu.*** *Zeitschrift für Analytische Chemie*, v. 165, no. 1, 1959, p. 16-19.

5131* Bismuthiol I as an Analytical Reagent. Estimation of Bismuth and Palladium. ***A. K. Majumdar and M. M. Charkrabartty.*** *Zeitschrift für Analytische Chemie*, v. 165, no. 2, 1959, p. 100-105.

5132* Analytical Aspects of Some Organic Acids. II. Gravimetric Estimation of Zirconium by m-Phenylenedioxydiacetic Acid. m-Phenylenedioxydiacetic acid is a selective reagent for the estimation of Zr. The acid gives a flesh-colored curdy precipitate in the presence of NH_4NO_3, which is quantitative up to 0.10 N HNO_3. ***C. S. Pande and T. S. Srivastava.*** *Zeitschrift für Analytische Chemie*, v. 165, no. 5, 1959, p. 343-347.

See also: **5402** (analysis of foods); **5440** (zinc toluene-3:4-dithiol in identifying minerals).

CHEMISTRY—INORGANIC AND GENERAL

5133 Recent Advances in Boron Technology. A summary of boron technology from Jan. 1955 to Aug. 1958. ***Richard A. Carpenter.*** *ARS Journal*, v. 29, Jan. 1959, p. 8-14.

5134* Chemical Action of Ionizing Rays. I. Introduction: Chemistry of Nuclear Radiation of Some Gases and Aqueous Solutions. Following a short introduction into the principles of the chemistry of nuclear radiation, the nuclear radiation chemistry of gases and aqueous solutions is dealt with and the decomposition of the moderator water in reactors is described. (*In German.*) Chemische Wirkungen ionisierender Strahlen. I. Einführung: Kernstrahlen-Chemie einiger Gase und wässriger Lösungen. ***Arnim Henglein.*** *Angewandte Chemie*, v. 71, no. 1, Jan. 7, 1959, p. 15-28.

5135 Inorganic Cyanamides. Physical and Optical Properties, and Decomposition. Stability to heat and light of a series of univalent metal cyanamides. ***S. K. Deb and A. D. Yoffe.*** *Faraday Society, Transactions*, v. 55, Jan. 1959, p. 106-113 + 1 plate.

5136* Studies on Hexachloroceric Acid. V. Stability, Spectral Characteristics and Electrical Conductance. VI. Pyridinium Ceric Chloride Complex. V. ***S. S. Moosath and M. R. A. Rao.*** VI. ***S. S. Moosath.*** *Indian Academy of Sciences, Proceedings*, v. 48, sec. A, no. 6, Dec. 1958, p. 317-329.

5137 The Preparation and Crystal Structure of Gallium Trifluoride. Includes modifications to existing analytical methods, which permit gallium and fluoride to be determined in the presence of one another. ***F. M. Brewer, G. Garton, and D. M. L. Goodgame.*** *Journal of Inorganic and Nuclear Chemistry*, v. 9, no. 1, Jan. 1959, p. 56-64.

5138* On Phosphorus-Nitrogen Compounds. VIII. The Reaction Between Phosphorus (V)-Oxide and Ammonia. Ammonolysis of the P_4O_{10}-molecule yields mainly derivatives of diphosphoric acid. By heating these reaction products to a temperature of about 100 C, an ammonium polyphosphate is formed in which half of the P atoms are linked by O atoms, half by NH-groups. (*In German.*) Über Phosphor-Stickstoff-Verbindungen. VIII. Über die Reaktion zwischen Phosphor(v)-oxyd und Ammoniak. ***Margot Becke-Goehring and Jörg Sambeth.*** *Zeitschrift für Anorganische und Allgemeine Chemie*, v. 297, nos. 5-6, Dec. 1958, p. 287-295.

5139* Preparing Cyanogen Chloride. A simple method for preparing very pure CNCl has been developed. A yield of about 100% is obtained by reaction of elementary Cl with an aqueous suspension of $K_2[Zn(CN)_4]$ at room temperature. (*In German.*) Zur Darstellung von Cyanchlorid. ***Hans Schröder.*** *Zeitschrift für Anorganische und Allgemeine Chemie*, v. 297, nos. 5-6, Dec. 1958, p. 296-299.

5140* Producing Molybdenum and Tungsten Carbonyls. From two to three hours are necessary to synthesize molybdenum carbonyl and one to 1.5 hours for tungsten carbonyl. Eighty-one to 85% tungsten carbonyl is obtained at reaction temperatures between 32 and 67 C. Eighty-three per cent molybdenum carbonyl is obtained between 85 and 96 C; this amount increases to 91% if the reaction is carried out in dichlorethane and ether at 45 C. (*In Russian.*) Poluchenie karbonilov molibdena i vol'frama. ***V. L. Volkov, E. P. Mikheev, K. N. Anisimov, L. E. Eliseeva, and Z. P. Valueva.*** *Zhurnal Neorganicheskoi Khimii*, v. 3, no. 11, Nov. 1958, p. 2433-2436.

CHEMISTRY—ORGANIC

5141* On the Reaction Between Substituted Cyanoacetic Esters and Methylene Bromide. The Preparation of α,α'-Di-(*tert.*-butyl)-glutaric Acid. ***Lennart Eberson.*** *Acta Chemica Scandinavica*, v. 12, no. 10, 1958, p. 1906-1910.

5142* Preparation and Infrared Spectra of 1 D-, 2 D-, 1,2 D_2-, and 1,2,2' D_3-Ethyl Fluorides and Bromides. In the spectra of the bromides the existence of rotational isomers is demonstrated. ***Børge Bak, Daniel H. Christensen, Jørgen Møller, and Snegulka Detoni.*** *Acta Chemica Scandinavica*, v. 12, no. 10, 1958, p. 2021-2027.

5143* Conjugate Additions of Grignard Reagents to alpha,beta-Unsaturated Esters. III. Additions of Methylmagnesium Bromide. IV. Cuprous Chloride Catalysed Additions to Ethyl Esters. Cuprous chloride catalyzed additions of methylmagnesium bromide to *sec*-butyl and ethyl esters of crotonic, tiglic, and cinnamic acids and to *sec*-butyl β,β-dimethylacrylate are described. Features of additions of Grignard reagents to α,β-unsaturated esters are considered. ***Jon Munch-Petersen.*** *Acta Chemica Scandinavica*, v. 12, no. 10, 1958, p. 2007 + 6 pages.

5144* Selective Catalytic Dehydrogenation of Saturated High Molecular Hydrocarbons in the Liquid Phase. (*In Russian.*) Izbiratel'naia kataliticheskaia degidrogenizatsiia predel'nykh vysokomolekhuliarnykh uglevodorodov v zhidkoĭ faze. ***S. R. Sergienko, E. V. Lebedev, and A. A. Petrov.*** *Akademiia Nauk SSSR, Doklady*, v. 123, no. 4, Dec. 1, 1958, p. 704-706 + 1 plate.

5145* Acid Properties of 3-Acylpyrazoles. (*In Russian.*) O kislotnykh svoĭstvakh 3-atsilpirazolov. ***Iu. N. Sheinker, I. Ambrush, and N. K. Kochetkov.*** *Akademiia Nauk SSSR, Doklady*, v. 123, no. 4, Dec. 1, 1958, p. 709-712.

5146 The Stability of Platinum-Styrene Complexes. Reaction of styrene with ethylene platinous chloride was used to prepare a series of substituted styrene-platinum complexes of the general formula $(X\text{-}C_6H_4CH{=}CH_2PtCl_2)_2$, where X=H, 3-Cl, 3-$CH_3O$, 4-$CH_3O$, 3-$NO_2$, 4-$NO_2$ and 4CH_3. ***John R. Joy and Milton Orchin.*** *American Chemical Society, Journal*, v. 81, Jan. 20, 1959, p. 305-310.

5147 Diaryliodonium Salts. IX. The Synthesis of Substituted Diphenyliodonium Salts. X. Catalysts and Inhibitors in the Reactions of Diphenyliodonium Ions With Anions and Hydroxylic Solvents. IX. ***F. Marshall Beringer, et al.*** X. ***F. Marshall Beringer, E. Melvin Gindler, Morris Rapoport, and Roy J. Taylor.*** *American Chemical Society, Journal*, v. 81, Jan. 20, 1959, p. 342-361.

5148 Reactions of Azobenzene- and Stilbene-Dilithium Adducts With Some Chlorosilanes. ***M. V. George, Dietmar Wittenberg, and Henry Gilman.*** *American Chemical Society, Journal*, v. 81, Jan. 20, 1959, p. 361-363.

5149 Synthesis of Some Amino Acid Derivatives of Styrene. Vinyl-substituted amino acids were prepared as intermediates in the synthesis of chelating polymers. ***L. R. Morris, R. A. Mock, C. A. Marshall, and J. H. Howe.*** *American Chemical Society, Journal*, v. 81, Jan. 20, 1959, p. 377-382.

5150 Steroids. CIV. Synthesis of 4,4-Dimethyl and 2,2-Dimethyl 19-nor-Hormone Analogs. CV. 2-Methyl and 2-Hydroxymethylene-androstane Derivatives. CVI. Synthe-

sis of 7β-Methyl Hormone Analogs. CVII. $\Delta^5(^6)$-19-Nor Steroids, a New Class of Potent Anabolic Agents. CIV. *A. Bowers and H. J. Ringold.* CV. *H. J. Ringold, E. Batres, O. Halpern, and E. Necoechea.* CVI. *John A. Zderic, Humberto Carpio, and H. J. Ringold.* CVII. *J. Iriarte, Carl Djerassi and H. J. Ringold.* *American Chemical Society, Journal*, v. 81, Jan. 20, 1959, p. 424-438.

5151 Synthesis of 7-(Dialkylaminoalkyl)-benzo[c]phenothiazines. *David A. Shirley and W. Earl Tatum.* *American Chemical Society, Journal*, v. 81, Jan. 20, 1959, p. 496-498.

5152 Grignard Synthesis of Alkyl Decaboranes. *John Gallaghan and Bernard Siegel.* *American Chemical Society, Journal*, v. 81, Jan. 20, 1959, p. 504.

5153 Some New Sulfur-Bearing Fluorocarbon Derivatives. Studies involving sulfur-bearing organic materials by the electrochemical process in HF are reported. *Richard D. Dresdner and John A. Young.* *American Chemical Society, Journal*, v. 81, Feb. 5, 1959, p. 574-577.

5154 The Synthesis of *p*-Vinylphenylboronic Acid and Some of Its Derivatives. *A. Kentaro Hoffmann and W. M. Thomas.* *American Chemical Society, Journal*, v. 81, Feb. 5, 1959, p. 580-582.

5155 The Synthesis and Polymerization of Tetrafluoroallene. *Thomas L. Jacobs and Ronald S. Bauer.* *American Chemical Society, Journal*, v. 81, Feb. 5, 1959, p. 606-610.

5156 Pyrolysis of Esters. XV. Effect of Temperature on Direction of Elimination of Tertiary Esters. XVI. Effect of Ring Size on Formation of Alicyclic Olefins. *William J. Bailey and Warren F. Hale.* *American Chemical Society, Journal*, v. 81, Feb. 5, 1959, p. 647-655.

5157 Synthesis of Some Conjugated Cyclobutane Polyolefins and Their 1,2-Cycloaddition to Tetracyanoethylene. *A. T. Blomquist and Yvonne C. Meinwald.* *American Chemical Society, Journal*, v. 81, Feb. 5, 1959, p. 667-672.

5158 Aminodihydrofuramides From 3-Amino-1-propynes and Carbon Monoxide. Synthesis was carried out by injecting carbon monoxide at 500-1000 atm. into the aminopropyne dissolved in a ketone solvent at a temperature of 125 C. *J. C. Sauer, B. W. Howk, and R. T. Stiehl.* *American Chemical Society, Journal*, v. 81, Feb. 5, 1959, p. 693-696.

5159 Thiolcarbamates. Preparation and Molar Refractions. Synthesis of 265 thiolcarbamates is described and the physical data of the compounds are tabulated. *Harry Tilles.* *American Chemical Society, Journal*, v. 81, Feb. 5, 1959, p. 714-727.

5160* Benzo-cycloheptatriene, Benzo-cyclooctatriene and Benzo-cyclooctatetraene. VI. A Communication on New Synthesis of Cyclopolyenes. The production of bifunctional phosphylenes from diphosphonium salts is described. On such a basis and starting from phthaldialdehyde, two isomer benzocycloheptatrienes and benzo-cyclooctatriene were synthesized. The latter led to a yet unknown benzo-cyclooctatetraene. (*In German.*) Benzo-cycloheptatrien, Benzo-cyclooctatrien und Benzo-cyclooctatetraen. VI. Mitteilung über neuartige Synthesen von Cyclopolyenen. *Georg Wittig, Heinrich Eggers, and Paul Duffner.* *Annalen der Chemie (Justus Liebigs)*, v. 619, nos. 1-3, 1958, p. 10-27.

5161* Derivatives of Trimethyl-1,8,8-bicyclo[3,2,1]octane. III. Synthesis of Trimethyl-1,8,8-bicyclo[3.2.1]octanols-2α and -2β and of Trimethyl-5,8,8-bicyclo[3,2,1]octanols-2α and -2β. IV. Determination of the Configurations of the Two Dimethyl-5,5-cyclohexanediols-1,3. V. Catalytic and Chemical Reductions of Trimethyl-1,8,8-bicyclo[3,2,1]octanedione-2,4. (*In French.*) Dérivés du triméthyl-1,8,8 bicyclo-[3,2,1]octane. III. Synthèse des triméthyl-1,8,8 bicyclo[3,2,1] octanols-2α et -2β et des triméthyl-5,8,8 bicyclo [3,2,1] octanols-2α et -2β. IV. Détermination des configurations des deux diméthyl-5,5 cyclohexanediols-1,3. V. Réductions catalytique et chimique de la triméthyl-1,8,8 bicyclo[3,2,1]octanedione-2,4. III. *H. Favre, M. Lefebvre, and J. C. Richer.* IV-V. *H. Favre and J. C. Richer.* *Canadian Journal of Chemistry*, v. 37, Feb. 1959, p. 403-426.

5162 The Chemical Effects of γ-Radiation on Organic Systems. III. The Action of Radiation on Triethylamine Alone or Mixed With Bromobenzene. Two new bases, *meso*- and racemic 2,3-bisdiethylaminobutane, were isolated from triethylamine which had been irradiated with γ-rays and were also synthesized chemically. *G. A. Swan, P. S. Timmons, and D. Wright.* *Chemical Society, Journal*, 1959, Jan., p. 9-13.

5163 Polyfluoroarenes. I. Pentafluorophenol. Hexafluorobenzene has been converted into pentafluorophenol under mild conditions and in good yield; derivatives and properties of pentafluorophenol are described. *J. M. Birchall and R. N. Haszeldine.* *Chemical Society, Journal*, 1959, Jan., p. 13-17.

5164 A General Stereoselective Synthesis of Olefins. A new procedure for making iodohydrins from epoxides, and a new reagent for reduction of iodohydrins to olefins are described, as well as a direct but nonstereospecific reduction of epoxides to olefins. *J. W. Cornforth, R. H. Conforth, and K. K. Mathew.* *Chemical Society, Journal*, 1959, Jan., p. 112-127.

5165 Aromatic Polyfluoro-Compounds I. The Synthesis of Aromatic Polyfluoro-Compounds From Pentafluorobenzene. *E. Nield, R. Stephens, and J. C. Tatlow.* *Chemical Society, Journal*, 1959, Jan., p. 166-171.

5166* On Terpenes. XCIX. The Structure of γ-Cadinene. (*In Czech.*) O terpenech. XCIX. Struktura γ-kadinenu. *Vladimír Sýkora, and Vlastimil Herout.* *Chemické Listy*, v. 52, no. 12, Dec. 1958, p. 2411-2413.

5167* Synthesis of Diallyl Phthalate Using Strongly Acid Cation Exchangers. (*In German.*) Die Synthese von Diallylphthalat mit stark sauren Kationenaustauschern als Katalysatoren. *Janusz Lindeman and Witold Trochimczuk.* *Chemische Technik*, v. 11, no. 1, Jan. 1959, p. 32-33.

5168* On Steroids. XXXII. Synthesis and Reactions of Δ^{15} Derivatives of Androstane. Chemical properties of 3β-acetoxy-15β,16α-dibromoandrostan-17-one and 3β-acetoxyandrost-15-en-17-one were studied. *J. Fajkoš.* *Collection of Czechoslovak Chemical Communications*, v. 23, no. 12, Dec. 1958, p. 2155-2168.

5169 Hydrolysis of Alkyl Sulfates. Effects of conditions of storage, such as temperature and actual pH of the solution. *R. R. Read and W. G. Fredell.* *Drug and Cosmetic Industry*, v. 84, no. 2, Feb. 1959, p. 178 + 2 pages.

5170* 1,3,4-Thiadiazoles. III. Acylation of the 2-Amino-1,3,4-thiadiazoles and Reduction by $LiAlH_4$ of the Products Obtained. Using $LiAlH_4$ to reduce 2-N-acyl derivatives leads to 2-alkylamino-5-phenyl-1,3,4-thiadiazoles. Acylation is obtained by means of 2-ethylamino-5-phenyl-1,3,4-thiadiazole. (*In Italian.*) 1,3,4-Tiadiazoli. III. Acilazione dei 2-amino-1,3,4-tiadiazoli e riduzione mediante $LiAlH_4$ dei prodotti ottenuti. *Emilio Testa, Gian Gualberto Gallo, and Franco Fava.* *Gazzetta Chimica Italiana*, v. 88, no. 12, Dec. 1958, p. 1272-1283.

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5258 Pipe Coating Adds to Draw Die Life. A new oxalate coating "Granodraw" increases drawing speeds 300%, protects the surface of stainless tubing and provides a good foundation for lubricants. Process cuts costs, reduces rejects, and leaves a better surface. *Steel*, v. 144, Feb. 23, 1959, p. 82-83.

5259 Electroless Copper Plating in Printed Circuitry. Deposition of Cu films on plastic circuit boards is discussed. Reducing agents, sensitizers, and coppering solutions are considered. Procedure for producing "plated-through" holes in circuit boards is described. ***E. B. Saubestre.*** *Sylvania Technologist*, v. 12, no. 1, Jan. 1959, p. 6-11.

5260 Clay (Kaolin). Nature of raw material, methods of preparation; mineralogical, chemical and physical properties of kaolins, degree of crystallinity, miscellaneous types of clay, chemical properties, physical properties, selection of clays for paper machine coating, processes which require thixotropic colors, correlation between pigment properties and coating behavior, general economic factors, methods for testing clays, viscosity, coating clay suspensions. ***S. C. Lyons.*** *TAPPI Monograph Series No. 20*, 1958, p. 57-115. (TS1080 T22tm Vis.)

5261 Colorants for Aqueous Mineral Coatings. Historical review, coloring materials, classification of dyestuffs, color preparation, shade matching. ***Maurice John Landberge.*** *TAPPI Monograph Series No. 20*, 1958, p. 116-129. (TS1080 T22tm Vis.)

5262 Luminescent Pigments. Source and commercial preparation, chemical and physical properties, paper coating properties. ***V. A. Belcher.*** *TAPPI Monograph Series No. 20*, 1958, p. 132-134. (TS1080 T22tm Vis.)

5263 Study of Anti-Fouling Paints With Special Regard to Drinking Water Tanks. (*In German.*) Untersuchungen über Unterwasseranstriche, insbesondere für Trinkwasserbehälter. ***G. Sille and O. Damm.*** *Technik*, v. 14, Jan. 1959, p. 39-42.

5264 Measurements of Total Hemispherical Emissivity of Several Stably Oxidized Metals and Some Refractory Oxide Coatings. Type 347 stainless steel, W, and Haynes alloys B, C, X, and 25 were the metals flame-sprayed with alumina and zirconia. ***William R. Wade.*** *U. S. National Aeronautics and Space Administration, NASA Memorandum* 1-20-59L, Jan. 1959, 30 pp. (TL782 Un3rm Vis.)

5265 Coal Tar Coatings. I. General review, raw materials, hot and cold applied coal tar coatings, coal tar coatings applications, future developments. ***Frank J. Kiernan.*** *West Virginia University, Technical Bulletin No. 52*, Oct. 1958, p. 170-180. (TA21 W52t Contin.)

5266* A Coordinated Wire Coating Line. Description of its elements and of their operation. ***Harry J. Bates.*** *Wire and Wire Products*, v. 34, Feb. 1959, p. 202-204.

See also: **5080** (diatomaceous earth plant); **5299** (protective metallic coatings); **5678** (pickling for porcelain enameling); **5701** (electroless Ni coatings, heat treatment); **5716** (coating for scuffing and wear on iron); **5791** (impurities and evaporating Si); **5950** (polycarbonate coatings).

CONTROL SYSTEMS, COMPUTERS, AND SYSTEMS ENGINEERING

5267 Analog Simulation. This book provides a comprehensive survey of analog techniques and systems for solving field problems, together with a concise presentation of the mathematical tools necessary for their optimum utilization. Presents the information needed by engineers and scientists to solve through analog methods any problem governed by a partial differential equation. ***Walter J. Karplus.*** 434 pp. 1958. McGraw-Hill, New York. (QA76.4 K14a)

5268* Nuclear Reactor Codes. Presents a comprehensive up-to-date list of nuclear codes used in reactor design. ***Virginia Nather and Ward Sangren.*** *Association for Computing Machinery, Communications*, v. 2, Jan. 1959, p. 6-32.

5269* News and Notices. Lists the characteristics of four digital computers manufactured within the Soviet Union. *Association for Computing Machinery, Communications*, v. 2, Jan. 1959, p. 33-34.

5270* Process Control by Computer—the Snags and How to Beat Them. Discusses planning and installation of control systems for chemical, petroleum and other continuous batch processes. ***Montgomery Phister, Jr.*** *Automation Progress*, v. 4, Feb. 1959, p. 40 + 3 pages.

5271* Transient Processes in a d.c. Circuit Composed of Ohmic Resistance and Semiconductor Thermistor. Transfer function and stability conditions are derived for the circuit consisting of a thermistor and ohmic resistance. The block diagrams of the circuit are given and the plotting of transient processes is described. (*In Russian.*) Perekhodnye protsessy v tsepi postoivannogo toka, sostavlennoĭ iz omicheskogo soprotivleniia i poluprovodnikovogo termosoprotivleniia. ***A. G. Shashkov.*** *Avtomatika i Telemekhanika*, v. 20, no. 1, Jan. 1959, p. 23-30.

5272* Precision Multiplier Element. Describes circuit of a multiplier element with static error less than 0.01-0.02% of the scale of output voltage. The small magnitude of the error is achieved by combining "rough" and "precise" system blocks. (*In Russian.*) Pretsizionnoe mnozhitel'noe zveno. ***L. N. Fitsner.*** *Avtomatika i Telemekhanika*, v. 20, no. 1, Jan. 1959, p. 62-69.

5273* Analysis and Synthesis of Some Contactless Circuits of Discrete Action. Considers algebraic methods of analysis and synthesis of code circuits, the main part of which is a network consisting of diode elements. The possibility of building economical circuits of such a type is discussed. (*In Russian.*) Analiz i sintez nekotorykh beskontaktnykh skhem diskretnogo deĭstviia. ***B. I. Rameev and Iu. A. Shreĭder.*** *Avtomatika i Telemekhanika*, v. 20, no. 1, Jan. 1959, p. 70-78.

5274* Ladder Matrix and the Substitution Circuit of a Transducer of the Electromagnetic Type. Comparison of various methods of the matrix and schematic representation of a polarized transducer. Describes possible methods of evaluating the influence of "negative rigidity" on its performance. (*In Russian.*) Tsepochechnaia matritsa i skhema zameshcheniia elektromekhanicheskogo preobrazovatelia elektromagnitnogo tipa. ***A. Ia. Mel'nichuk.*** *Avtomatika i Telemekhanika*, v. 20, no. 1, Jan. 1959, p. 79-84.

5275* Ten Years of Computer Development. This paper gives a historical account of how computers have developed in the United Kingdom. ***Earl of Halsbury.*** *Computer Journal*, v. 1, no. 4, Jan. 1959, p. 153-159.

5276 Electronic Digital Computers. This book is intended for physicists, chemists, engineers, and others who have occasion to require the solution of computational problems by means of digital computing machines. This book is about computing specialists and the work they perform when using a modern digital computer. ***Franz L. Alt.*** 336 pp. 1958. Academic Press, New York. (QA76 AL79e)

5277 Tape Recording System Speeds Data Processing. Describes the information format, read and write circuits, and tape transport mechanism which enables data processing system to handle information at a rate of 60,000 digits or 40,000 alphanumeric characters a second. ***Way Dong Woo.*** *Electronics*, v. 32, no. 6, Feb. 6, 1959, p. 56-58.

5278 Simple Codes for Fading Circuits. Four relatively simple, redundantly coded, binary communication systems are considered under certain limiting conditions of signal fading. The results indicate that the redundant systems offer significant gains under most of the assumed conditions, but that additional propagation research is required before general codes can be developed for turbulent channels. ***Herbert B. Voelcker, Jr.*** *IRE Transactions on Communications Systems*, v. CS-6, no. 2, Dec. 1958, p. 47-52. (TK1 In6.6cs Vis.)

5279 A Numerically Controlled Manufacturing System. Describes operation of the equipment used for automatic numerical control of multipurpose machine tools. Also, operating experience in existing installations is discussed. ***F. E. Booth.*** *IRE Transactions on Industrial Electronics, PGIE-8*, Jan. 1959, p. 2-16. (TK1 In6.6ie Vis.)

5280 A High-Speed Low-Level Scanner. A scanner is described which can scan 500 pairs of strain-gage inputs at a repetition rate of 50 pairs per second, under control of a train of control pulses. A minimum dwell time of 5 msec is needed. Its life is such that at least 20 million operations can be expected without readjustment, and the scanning rate must be at least 50 points per second. ***Kurt Enslein.*** *IRE Transactions on Industrial Electronics, PGIE-8*, Jan. 1959, p. 17-24. (TK1 In6.6ie Vis.)

5281 A Positioning Servo for Automatic Machine Tool Operation. This paper describes a relay servo system used in the positioning of machine tools. Its primary application is in the manufacture of parts that have to fit accurately other parts on which all machining has been completed. ***Fred H. London.*** *IRE Transactions on Industrial Electronics, PGIE-8*, Jan. 1959, p. 31-33. (TK1 In6.6ie Vis.)

5282* Evaluation of Performance of Polystyrene Components of Fluorescent Luminaires in Actual Service and Under Accelerated Testing. ***D. A. Popielski and R. A. McCarthy.*** *Illuminating Engineering*, v. 54, Feb. 1959, p. 83-91.

5283* Can Machines Be Intelligent? A review of the Symposium on "The Mechanization of Thought Processes" held at the National Physical Laboratory during November 24-27, 1958. ***M. A. Wright.*** *Process Control and Automation*, v. 6, Jan. 1959, p. 2-6.

5284 Switching Circuits With Computer Applications. Covers the most important single application of switching circuits . . . digital systems. The methods described greatly simplify the design of modern high-speed digital computers and their multitude of individual switching-circuit networks. The sound and thorough treatment of switching-circuit techniques allows the designer to complete the detailed organization of very large systems without drawing a single circuit diagram. The resulting equations can then be converted directly to logical, or simplified schematic form. ***Watts S. Humphrey, Jr.*** 264 pp. 1958. McGraw-Hill, New York. (TK7885 H88s)

See also: **5043** (chemical process design on an analog computer); **5071** (ethylene oxide plant instrumentation); **5467** (automation in the mineral industry); **5882** (Clegsch-Gordan coefficients).

ELECTRICAL ENGINEERING

5285* Terminal for Twelve-Channel Military Telephone. Describes the first twelve-channel military carrier telephone system. The terminal is easily set up and maintained, and it operates over a broad range of temperatures and humidities. ***B. A. Fairweather.*** *Bell Laboratories Record*, v. 37, Feb. 1959, p. 60-63.

5286* Development to Increase the Output of the Brown Boveri Contact Rectifier. This article demonstrates that, for high unit outputs at d.c. voltages, mechanical (contact) rectifiers are less expensive than other forms of a.c.-d.c. converter. ***H. Blatter.*** *Brown Boveri Review*, v. 45, no. 10, Oct. 1958, p. 449-461.

5287* Remote 33-Kv Switching Improves Reliability, Defers Investment. Impressive reductions in outage time have resulted from development of a new selective-control system for operation of switches on either side of tap feeds on 33-kv systems, which permits postponement or elimination of second supply line otherwise required. ***J. W. Gallagher.*** *Electric Light and Power*, v. 37, no. 4, Feb. 15, 1959, p. 67 + 5 pages.

5288* Self-Ballasted Vapor Lamps—New Basic Design Data and New Improved Types. New quantitative data are presented as a basis for optimum designs and for a discussion of the possibilities and limitations of self-ballasted lamps. The characteristics of two new experimental types of 450 watts and 1750 watts are described. ***Herbert S. Strauss and Wolfgang E. Thouret.*** *Illuminating Engineering*, v. 54, Feb. 1959, p. 96-106.

5289* A Versatile Method of Calculating Illumination and Brightness. A review of the inadequacies of our present system for making lighting calculations has been made, and a possible system, which overcomes many of the disadvantages of the present system, presented. ***B. F. Jones and J. R. Jones.*** *Illuminating Engineering*, v. 54, Feb. 1959, p. 113-121.

5290* Multilayer Polarizers and Their Application to General Polarized Lighting. Describes the properties of multilayer polarizers and their unique application to general polarized lighting, as well as the results obtained through the use of general polarized illumination. ***Alvin M. Marks.*** *Illuminating Engineering*, v. 54, Feb. 1959, p. 123-135.

5291* The Self-Extinction of Gaseous Discharges in Cavities in Dielectrics. The paper describes investigations of the variations of discharge-extinction voltage which occur when a dielectric sample containing a single air-filled cavity is subjected to a 50 c/s testing voltage greater than that required to initiate discharges in the cavity. ***E. C. Rogers.*** *Institution of Electrical Engineers, Proceedings*, v. 105, pt. A, no. 24, Dec. 1958, p. 621-630.

5292* A Method of Analysis and Calculation of Multi-Phase Ferromagnetic Frequency Multipliers. Describes a general analytical method of analyzing processes in a *n*-phase ferromagnetic frequency multiplier whose multiplication factor is equal to the number of the phases in its primary winding. The calculation formulas are simple and convenient for practical

use and produce a satisfactory accuracy of calculations. (*In Russian.*) Metod analiza i rascheta mnogofaznyk ferromagnitnykh umnozhitelei chastoty. ***N. G. Maksimovich and Iu. E. Batranin.*** *Izvestiia Vysshikh Uchebnykh Zavedenii, Energetika*, 1958, no. 10, Oct., p. 49-58.

See also: **5281** (servo system); **5282** (fluorescent lights).

ELECTROCHEMISTRY

5293* Electrical Conductivity of Melts in the Systems NaCl-$ZrCl_4$ and NaCl-KCl (1:1 molar)-$ZrCl_4$. ***L. J. Howell and H. H. Kellogg.*** *American Institute of Mining, Metallurgical, and Petroleum Engineers, Transactions, Metallurgical Society*, v. 215, no. 1, Feb. 1959, p. 143-145.

5294 Mechanism of Electrodeposition of Nickel From Liquid Ammonia Solutions of Spin-Free Nickel(II) Complexes. Data on cathode current efficiencies for the electrolysis of solutions of $[Ni(NH_3)_6]^{2+}$, $[Ni(en)_3]^{2+}$, and $[Ni(dn)_2]^{2+}$ in the presence of Br^-, I^-, and SCN^- are interpreted on the basis of an S_N2 mechanism. ***George W. Watt and David A. Hazlehurst.*** *Electrochemical Society, Journal*, v. 106, Feb. 1959, p. 117-119.

5295 Electrodeposition of Molybdenum. Research was directed toward the electrodeposition of molybdenum from nonaqueous media such as liquid ammonia, formamide, acetamide, hydrazine, and other organic solvents and the preparation of pure anhydrous molybdenum halides. While thin plates of molybdenum were obtained, the growth of massive deposits was not realized. ***T. T. Campbell.*** *Electrochemical Society, Journal*, v. 106, Feb. 1959, p. 119-123.

5296 Electrolysis of Organic Solvents With Reference to the Electrodeposition of Metals. The subject matter is divided into two parts. Attempts to electrodeposit metals from nonaqueous media are discussed and next, the more fundamental subject, the electrolysis of nonaqueous solvents themselves. ***Abner Brenner.*** *Electrochemical Society, Journal*, v. 106, Feb. 1959, p. 148-154.

5297 Anodizing and Coloring Aluminum in Britain. Procedures are given for pretreatment, anodizing and coloring to produce a light-fast finish. ***Tom Bishop.*** *Metal Progress*, v. 75, no. 1, Jan. 1959, p. 87-89.

5298* High-Strength Steel Can Be Cadmium Plated Without Embrittlement. Cadmium is plated from a cyanide bath at 70 amp. per sq. ft. to give a porous plate which permits hydrogen to diffuse out of the surface in subsequent bake. ***D. J. Cash and W. Scheuerman.*** *Metal Progress*, v. 75, no. 2, Feb. 1959, p. 90-93.

5299 Protective Metallic Coatings. The word coating usually implies an intimate or "skin tight" covering applied after a part or structure is in its final bulk form. On the basis of properties at very high temperature, methods of application, and properties of their alloys, the metals in Table I have received the most attention as coatings. The temperature to be reached in service, the time at temperature, and the size and complexity of the part will indicate which of the metals is a coating prospect and which of the processes should be used for applying the coating. The following factors will determine whether the coating will provide the desired heat tolerance: oxidation (and/or corrosion) resistance; thermal stability; coefficient of thermal expansion relative to that of the basis metal; propensity for diffusion alloying with the basis metal at the interface; properties of such a diffusion alloy zone relative to the performance needs; melting point of the coating and of the diffusion alloy zone. ***Charles L. Faust.*** Paper from "Metals for Supersonic Aircraft and Missiles", p. 170-201, 1958. American Society for Metals, Cleveland. (TL699.M4 M56)

5300 Plating—Yesterday, Today and Tomorrow. ***A. Kenneth Graham.*** *Plating*, v. 46, Feb. 1959, p. 150-153.

5301 Progress on Alloy Plating. I. Tungsten and Molybdenum Alloys. Iron, Co and Ni appear to be the only alloying elements that make possible the codeposition of substantial amounts of W or Mo. Alloys of other metals can be produced, but very high current densities are required and current efficiency is very low. Both compositions and conditions are tabulated. ***William H. Safranek and Luther E. Vaaler.*** *Plating*, v. 46, Feb. 1959, p. 133-143.

See also: **5113** (analysis of electroplating baths); **5227** (finishes for aluminum); **5653** (thicker decorative Cr for better corrosion resistance); **5674** (electrolytic Ta recovery).

ELECTRONICS

5302* Spatial and Intermittent Partial Waves in Electron Streams. In systems having a spatial structure changing with time, the propagation phenomenon can be described by a sum of waves having different phase velocities and different frequencies, i.e., by partial waves. If a traveling wave of high intensity acts upon an electron beam, partial waves of different frequencies will be generated. (*In German.*) Räumliche und zeitliche Teilwellen in Elektronenströmungen. ***Rudolf Müller.*** *Archiv der Elektrischen Übertragung*, v. 12, Dec. 1958, p. 527-532.

5303* Power Matching in Four-Terminal Networks With Complex Parameters. Expressions are derived for passive "matching impedances" required for maximum amplification of the active power and for the maximum amplified power thus obtained. The study refers to "unconditionally stable" four-pole networks; a simple criterion for "unconditional" stability is derived. (*In German.*) Leistungsanpassung bei Vierpolen mit komplexen Parametern. ***Hans-Jürgen Butterweck.*** *Archiv der Elektrischen Übertragung*, v. 12, Dec. 1958, p. 540-544.

5304* Frequency and Temperature Behavior of the Complex Permeability of Highly Permeable Ferrites. (*In German.*) Der Frequenz- und Temperaturgang der komplexen Permeabilität hochpermeabler Ferrite. ***Dankwart Köhler.*** *Archiv der Elektrischen Übertragung*, v. 13, Jan. 1959, p. 1-12.

5305* Behavior of the Triode in the Transit-Time Region Under Strong Driving Signals. The influence of an increasing drive onto input impedance, gain curve, and electronic efficiency of a triode in the transit-time region are theoretically investigated. An increasing drive effects accordingly among other results a reduction of the magnitude of the gain, a forward shift of the phasor of the gain and an increase in the electronic efficiency. The results are interpreted physically, and compared with the partial results already attained by other authors, with which they are in fair agreement. (*In German.*) Das Verhalten der Triode im Laufzeitgebiet bei hohen Aussteuerungsgraden. ***Gustav Heinzmann.*** *Archiv der Elektrischen Übertragung*, v. 13, Jan. 1959, p. 13-20.

5306* A Broadband Microwave Calorimeter for High Powers. A broadband calorimeter has been developed in which the dissipative structure is not inserted in the main guide but coupled to the main guide by a grid of wires in the side wall. The power is measured by a substitution method and the total error is less than 2%. (*In German.*) Ein breitbandiges Mikrowellenkalorimeter für hohe Leistungen. ***Tycho Jaeger and Martin Victor Schneider.*** *Archiv der Elektrischen Übertragung*, v. 13, Jan. 1959, p. 21-25.

5307* Equivalent Circuit and Amplification Properties of the Surface Transistor. It is shown that the dependence of the quadripole parameters and the optimum power gain on frequency and emitter current can be calculated very accurately by considering the newly introduced control factor and by a separation of the barrier-layer and diffusion capacitances. A suitable method is devised for determining the elements of the equivalent circuit. For the case of selective amplifier the amplification properties of the transistor are investigated in their dependence on the operating conditions and the elements of the equivalent circuit. (*In German.*) Ersatzschaltbild und Verstärkungseigenschaften des Flächentransistors. ***Waldemar Moortgat-Pick.*** *Archiv der Elektrischen Übertragung*, v. 13, Jan. 1959, p. 33-48.

5308* Thermocompensators on a Silicon-Carbide Base. Describes SiC-based, low-ohm and high-ohm thermocompensating electrical resistances operating at temperatures up to 300 C and dissipating power up to 25 watts. (*In Russian.*) Termokompensatory na osnove karbida kremniia. ***P. I. Bresker and N. I. Voronin.*** *Avtomatika i Telemekhanika*, v. 20, no. 1, Jan. 1959, p. 95-96.

5309 Preparation of Metal Film Resistors on Laminated Plastics. Shows that melamine protected films of nickel-chromium alloy up to about 800Ω/square and sandwich films of gold between bismuth oxide up to about 50Ω/square, deposited on to certain epoxy and polyester resin bonded laminates can be stabilized by aging. ***G. Siddall and G. Smith.*** *British Journal of Applied Physics*, v. 10, Jan. 1959, p. 35-39.

5310 Electric Conduction in Semiconductors and Metals. This book is an introduction to the physics of semiconductors. Particular attention is given to their electrical properties, which are reviewed together with the corresponding properties of metals. The book is a systematic presentation of the essential facts and ideas, rather than a treatise in which all developments are surveyed. ***W. Ehrenberg.*** 389 pp. 1958. The Clarendon Press, Oxford. (QC611 Eh83e)

5311* Relaying by Microwave Proves Reliable. Crowded carrier spectrums and spurious signals from other sections of a large interconnected system have been eliminated through use of microwave. Results have been excellent. ***V. I. Easterday and D. W. Anderson.*** *Electric Light and Power*, v. 37, no. 4, Feb. 15, 1959, p. 58-62.

5312* Two Dimensional Transistor Packaging. Description of techniques for working with ceaseless transistors. ***J. W. Lathrop, J. R. Nall, and R. J. Anstead.*** *Electronic Design*, v. 7, no. 4, Feb. 18, 1959, p. 50-52.

5313* Connections. Recent developments relating to connections between equipment, connections inside equipment, and rf connections. ***L. N. Tolopko.*** *Electronic Design*, v. 7, no. 4, Feb. 18, 1959, p. 53 + 12 pages.

5314 A Microwave Frequency Standard. I.-II. This article describes an equipment which produces positively identified signals for calibration purposes in the frequency range 7kMc/s to 20kMc/s: Both limits may be extended. The smallest intervals available are not greater than 0.03% of the calibration frequency, the signals being synthesized from a low-frequency temperature-controlled crystal oscillator with a short term stability of better than 1 part in 10^7, which can be directly compared with an accurately known BBC frequency. ***B. H. L. James and M. T. Stockford.*** *Electronic Engineering*, v. 31, Jan. 1959, p. 2-7; Feb. 1959, p. 82-87.

5315 A Microwave Reflectometer Display System. An X-band reflectometer display system which has recently been developed, is described. This instrument gives a continuous display of the match of an X-band waveguide component over a frequency band of 7,500 to 11,000 Mc/s. The instrument is primarily intended for the display and comparison of standing wave ratios of the order of 1.5 or more. Some discussion of the sources of error to be expected in the system is given together with details of tests made to ascertain operation accuracy. ***J. C. Dix and M. Sherry.*** *Electronic Engineering*, v. 31, Jan. 1959, p. 24-29.

5316 Waveguide Switches and Branching Networks. Waveguide switches of the barrel, gas discharge tube, and ferrite types are compared. Branching tee properties and applications are discussed in detail. Description of a multiple branching network using hybrids. ***J. W. Sutherland.*** *Electronic Engineering*, v. 31, Feb. 1959, p. 64-68.

5317 The Use of Dekatrons for Pulse Distribution. Discusses three methods for increasing the number of output lines for pulse generation on several output lines and in a fixed time sequence. ***G. H. Stearman.*** *Electronic Engineering*, v. 31, Feb. 1959, p. 69-71.

5318 Transistor Bias Design From Thermal Incremental Properties. Explicit formulae for the design of single stage bias networks are given. Theoretical expressions and experimental procedures for the derivation of these properties are discussed in detail. Actual applications and experimental verifications of the theory are included. ***L. M. Vallese.*** *Electronic Engineering*, v. 31, Feb. 1959, p. 88-93.

5319 Instrumenting the Explorer I Satellite. Describes a philosophy of instrumentation of minimal-weight satellites and the results of design decisions based on estimated effects. ***Henry L. Richter, Jr., William Pilkington, John P. Eyraud, William S. Shipley, and Lee W. Randolph.*** *Electronics*, v. 32, no. 6, Feb. 6, 1959, p. 39-43.

5320 Magnetic Drum Provides Analog Time Delay. Drum recording system developed to make analog simulations in designing continuous-processing system provides time delay. Precision of 0.1 percent between recorded and played-back low-frequency analog voltages is exceeded in highly stable system applicable also to tape. ***H. L. Daniels and D. K. Sampson.*** *Electronics*, v. 32, no. 6, Feb. 6, 1959, p. 44-47.

5321 Wideband Amplifier Design Data. Circuits, relationships and equations are presented to help the circuit designer confronted with the problem of securing both high gain and wide bandwidth. ***Richard H. Engelmann.*** *Electronics*, v. 32, no. 6, Feb. 6, 1959, p. 48-49.

5322 Stable, Low-Cost One-Mc Oscillator. Compact one-mc transistorized oscillator yields a frequency stability of one part in 10^9 per day at normal room temperature. A 12-lb., 45-v battery can furnish both oven and circuit power for 72 hours at room temperature. ***Joseph F. Mercurio, Jr.*** *Electronics*, v. 32, no. 6, Feb. 6, 1959, p. 50-51.

5323 New Self-Sustained Emission Tube. Describes a new cold-cathode self-sustaining emission tube. Advantages: less cathode power required for operation, quick starting, longer life, no trouble from faulty heater operation. *Electronics*, v. 32, no. 6, Feb. 6, 1959, p. 66 + 2 pages.

5324* Quartz Oscillators With Neutralization. Recommendations are given for the selection of the circuit and parameters of such oscillators. (*In Russian.*) Kvartsevye generatory s neĭtralizatsieĭ. ***L. A. Korneev.*** *Elektrosviaz'*, v. 12, no. 12, Dec. 1958, p. 10-15.

5325* On the Relationship Between Interference Intensity and the Receiving-Transmitting Line Characteristics With Pulse-Phase Modulation. Describes a method of calculating interference intensity in a radio transmission line. The method is based on the use of transfer pulse functions and on the determination of the receiver's reaction to the pulses of the input signal derivative. Simple calculation formulas are derived. It is shown that the interference intensity is determined by the signal power in the pulse and by pulse energy. (*In Russian.*) O zavisimosti intensivnosti pomekhi v radioreleĭnoĭ linii ot kharakteristik priemoperedaiushchego trakta pri impul'sno-fazovoĭ moduliatsii. ***G. V. Dlugach.*** *Elektrosviaz'*, v. 12, no. 12, Dec. 1958, p. 16-25.

5326* Piezoelectrical Filter Containing Inductance Coils With the Given Coupling Coefficient. New circuits are considered for piezoelectrical filters for low and high frequencies, containing inductively coupled coils. The measured characteristics of the working attenuation are given. Methods are described for measuring the coupling coefficent and for determining its temperature dependence. (*In Russian.*) Piezoelektricheskie fil'try soderzhashchie katushki induktivnosty s zadanym koeffitsientom sviazi. ***Z. Ia. Gel'mont.*** *Elektrosviaz'*, v. 12, no. 12, Dec. 1958, p. 58-64.

5327 Calculation of Directional Antenna Patterns Using Digital Computer Techniques. Describes the procedure used for and a typical program sequence obtained in calculation of directional antenna patterns using digital computer techniques. ***Serge Bergen.*** *IRE Transactions on Broadcast Transmission Systems, PGBTS-12*, Dec. 1958, p. 22-24. (TK1 In6.6bt Vis.)

5328 Dependence of the Maximum Range of Tropospheric Scatter Communications on Antenna and Receiver Noise Temperatures. This paper describes the dependence of the maximum range of scatter communications on noise sources both internal and external to the communications system. It is shown that the apparent antenna temperature constitutes the primary limitation in realizing the full advantages of the low

noise solid state amplifiers currently of such great interest. ***Arthur H. Hausman.*** *IRE Transactions on Communications Systems*, v. CS-6, no. 2, Dec. 1958, p. 35-38. (TK1 In6.6cs Vis.)

5329 Reduction of Adjacent-Channel Interference Components From Frequency-Shift-Keyed Carriers. Analysis showed that reductions in interfering bandwidths of 10 to 1 or greater over unfiltered keying at sideband levels 80 db or more below the unmodulated carrier are possible. The frequency spectra resulting from filtered keying waves of FSK transmitters are derived, and the results presented in graphic form. ***A. D. Watt, V. J. Zurick, and R. M. Coon.*** *IRE Transactions on Communications Systems*, v. CS-6, no. 2, Dec. 1958, p. 39-47. (TK1 In6.6cs Vis.)

5330 Transmission Loss Curves for Propagation at Very Low Radio Frequencies. Curves of the transmission loss are presented for the propagation to great distances at frequencies in the range 10 to 20 kc. The calculated results compare favorably with experimental data at 16.6 kc over the Pacific Ocean. ***James R. Wait.*** *IRE Transactions on Communications Systems*, v. CS-6, no. 2, Dec. 1958, p. 58-61. (TK1 In6.6cs Vis.)

5331 Ferrite High-Power Effects in Waveguides. Deterioration of ferrite devices caused by both high power thermal and nonlinear effects are discussed and a theoretical maximum power capacity is derived in terms of ferrite configuration parameters. It is shown that high power effects may be eliminated in ferrite devices by properly choosing ferrite properties and geometry. ***E. Stern and R. S. Mangiaracina.*** *IRE Transactions on Microwave Theory and Techniques*, v. MTT-7, no. 1, Jan. 1959, p. 11-15. (TK1 In6.6mt Vis.)

5332 Temperature Effects in Microwave Ferrite Devices. With proper choice of shape, it is possible to minimize the frequency shift of ferromagnetic resonance in microwave ferrite components operating over a wide range of ambient temperatures. Design curves are presented for reducing dependence of resonance frequency on temperature. ***J. L. Melchor and P. H. Vartanian.*** *IRE Transactions on Microwave Theory and Techniques*, v. MTT-7, no. 1, Jan. 1959, p. 15-18. (TK1 In6.6mt Vis.)

5333 Characteristics of Ferrite Microwave Limiters. One application of the ferrite limiter is in the protection of crystal detectors in pulsed radar sets. Experimental techniques used to improve the performance of the limiter are presented, and the performance characteristics of an *X*-band ferrite microwave limiter are shown. ***G. S. Uebele.*** *IRE Transactions on Microwave Theory and Techniques*, v. MTT-7, no. 1, Jan. 1959, p. 18-23. (TK1 In6.6mt Vis.)

5334 Ferrite Phase Shifter for the UHF Region. An extremely compact, low-loss, ferrite phase shifter has been developed for the 200 to 800-mc region by means of which field swings of about 900 oersteds (from 430 to 1250 oersteds at 400 mc), 360° change in phase shift can be obtained with about 1 db of loss. Additional data are included on the operation of the phase shifter down to 10 mc and up to 2000 mc. ***C. M. Johnson.*** *IRE Transactions on Microwave Theory and Techniques*, v. MTT-7, no. 1, Jan. 1959, p. 27-31. (TK1 In6.6mt Vis.)

5335 A Ferrite Serrodyne for Microwave Frequency Translation. A ferrite serrodyne has been developed to produce a frequency translation of *X*-band microwave signals over ranges from 0 to 50 kc at a conversion rate of 1 to 2 db. Suppression of spurious output spectral components is 33 db or more for a 10-kc translation and 21 db for a 50-kc translation. ***F. J. O'Hara and H. Scharfman.*** *IRE Transactions on Microwave Theory and Techniques*, v. MTT-7, no. 1, Jan. 1959, p. 32-37. (TK1 In6.6mt Vis.)

5336 Broad-Band Ferrite Rotators Using Quadruply-Ridged Circular Waveguide. Shows that variations in the rotation of the plane of polarization wave propagating in a magnetized unbounded ferrite waveguide is substantially due to the waveguide characteristics, and can be minimized by lowering the cutoff frequency of the waveguide. ***H. N. Chait and N. G. Sakiotis.*** *IRE Transactions on Microwave Theory and Techniques*, v. MTT-7, no. 1, Jan. 1959, p. 38-41. (TK1 In6.6mt Vis.)

5337 Present State of the Millimeter Wave Generation and Technique Art—1958. Current work on frequency multiplication using relativistic megavolt beams, crystal diodes, field emitters, ferrites, etc., is reviewed. Waveguide components used at 1 to 2 mm. are described. ***P. D. Coleman and R. C. Becker.*** *IRE Transactions on Microwave Theory and Techniques*, v. MTT-7, no. 1, Jan. 1959, p. 42-61. (TK1 In6.6mt Vis.)

5338 Millimeter-Wave Generation Experiment Utilizing Ferrites. Describes how at least 50 watts of peak power at 2-mm wavelength has been generated from 4-mm excitation by harmonic generation in ferrites. Components such as a 4-mm high-power isolator, a calorimeter for measurement of the 4-mm and 2-mm power, and numerous 2-mm waveguide components are also described. ***Wesley P. Ayres.*** *IRE Transactions on Microwave Theory and Techniques*, v. MTT-7, no. 1, Jan. 1959, p. 62-65. (TK1 In6.6mt Vis.)

5339 Some Characteristics of Dielectric Image Lines at Millimeter Wavelengths. The attenuation characteristics of several dielectric image lines have been calculated for the frequency range extending from 24 to 100 kmc and have been checked experimentally at 35 and 70 kmc. A new type of image line, called the tape line, is described. ***James C. Wiltse.*** *IRE Transactions on Microwave Theory and Techniques*, v. MTT-7, no. 1, Jan. 1959, p. 65-69. (TK1 In6.6mt Vis.)

5340 The Interaction of Microwaves With Gas-Discharge Plasmas. A summary is presented of the present state of knowledge of the interaction of microwaves with gas-discharge plasmas. Examples are given of the interaction of high density and low density gas-discharge plasmas in S-band resonant cavities, both in the presence and absence of dc magnetic fields. ***Sanborn C. Brown.*** *IRE Transactions on Microwave Theory and Techniques*, v. MTT-7, no. 1, Jan. 1959, p. 69-72. (TK1 In6.6mt Vis.)

5341 High Power, Magnetic Field Controlled Microwave Gas Discharge Switches. A new type of gas discharge switch is described. Two different switch configurations are investigated, one a Y-junction switch for operation at S band and the other a balanced top-wall hybrid coupler switch for operation at K_u band. Their electrical characteristics are described. ***S. J. Tetenbaum and R. M. Hill.*** *IRE Transactions on Microwave Theory and Techniques*, v. MTT-7, no. 1, Jan. 1959, p. 73-82. (TK1 In6.6mt Vis.)

5342 Solid-State Microwave Amplifiers. This paper reviews the method of operation of the masers and the parametric amplifiers, discusses the performance achieved and achievable by the various versions, and points up some of the difficulties involved in effectively utilizing the extremely low-noise figures obtainable. ***Hubert Heffner.*** *IRE Transactions on Microwave Theory and Techniques*, v. MTT-7, no. 1, Jan. 1959, p. 83-91. (TK1 In6.6mt Vis.)

5343 A UHF Solid-State Maser. Describes the operation of chromium doped potassium cobalticyanide that has been utilized in the design and construction of a solid-state maser operating in the frequency range of 300 to 500 mc. The pumping frequency is fixed at 5400 mc and the magnetic field required is in the vicinity of 80 gauss. ***R. H. Kingston.*** *IRE Transactions on Microwave Theory and Techniques*, v. MTT-7, no. 1, Jan. 1959, p. 92-94. (TK1 In6.6mt Vis.)

5344 A Microwave Frequency Standard Employing Optically Pumped Sodium Vapor. Describes an instrument in which a simple microwave triode oscillator is stabilized by reference to a natural atomic resonance—the field-independent hyperfine resonance of sodium. Such systems can be engineered into quite small packages, making possible many new applications of microwave oscillators stabilized to high order. ***W. E. Bell, A. Bloom, and R. Williams.*** *IRE Transactions on Microwave Theory and Techniques*, v. MTT-7, no. 1, Jan. 1959, p. 95-98. (TK1 In6.6mt Vis.)

5345 Microwave Filter Design Using an Electronic Digital Computer. Describes how a transmission-line circuit can be analyzed by a digital computer. Examples are given to indicate time and cost of both analysis and synthesis procedures on an IBM Type 650 digital computer. The synthesis of a stagger-tuned three-cavity filter is described. ***Leo Young.*** *IRE Transactions on Microwave Theory and Techniques*, v. MTT-7, no. 1, Jan. 1959, p. 99-101. (TK1 In6.6mt Vis.)

5346 Measurement of Two-Mode Discontinuities in a Multimode Waveguide by a Resonance Technique. This paper presents a resonance measurement technique for the precise evaluation of the equivalent network for a lossless shunt discontinuity coupling two nondegenerate modes in a multimode waveguide. Computations and experimental results obtained at S band illustrative of the procedure are presented for shunt discontinuities coupling the E_{01} and H_{01} modes in circular waveguide. ***L. B. Felsen, W. K. Kahn, and L. Levey.*** *IRE Transactions on Microwave Theory and Techniques*, v. MTT-7, no. 1, Jan. 1959, p. 102-110. (TK1 In6.6mt Vis.)

5347 Mode Couplers and Multimode Measurement Techniques. Theoretical and practical details for mode couplers for the first five modes in rectangular waveguide are presented, as well as the application and limitations of this measurement technique. ***D. J. Lewis.*** *IRE Transactions on Microwave Theory and Techniques*, v. MTT-7, no. 1, Jan. 1959, p. 110-116. (TK1 In6.6mt Vis.)

5348 Measurement of Harmonic Power Generated by Microwave Transmitters. A measurement technique is described that can be used to determine quantitatively the power levels of the higher order modes propagating in a straight, lossless, rectangular waveguide. ***Vernon G. Price.*** *IRE Transactions on Microwave Theory and Techniques*, v. MTT-7, no. 1, Jan. 1959, p. 116-120. (TK1 In6.6mt Vis.)

5349 Tunable Passive Multicouplers Employing Minimum-Loss Filters. Several multicoupler techniques are described for operating twenty or more UHF transmitters and receivers simultaneously with a single localized antenna system. ***J. F. Cline and B. M. Schiffman.*** *IRE Transactions on Microwave Theory and Techniques*, v. MTT-7, no. 1, Jan. 1959, p. 121-127. (TK1 In6.6mt Vis.)

5350 A Wide-Band Strip-Line Balun. Design data and theoretical performance curves are presented for a new wide-band strip-line balun that uses a pair of dual coupled-strip-line band-pass filters. It can operate over bandwidths up to about 8:1 in the frequency range of about 100 to 10,000 mc. ***E. M. T. Jones and J. K. Shimizu.*** *IRE Transactions on Microwave Theory and Techniques*, v. MTT-7, no. 1, Jan. 1959, p. 128-134. (TK1 In6.6mt Vis.)

5351 A Study of a Serrated Ridge Waveguide. The serrated, or periodically slotted ridge produces a periodic loading which retards the phase velocity of the wave in a waveguide. Such structures may be used to provide a variable index of refraction for microwave lenses and as elements in microwave filters. Two approaches are presented in this paper giving the frequency dependence of the index of refraction. Circuit parameters which determine the shape of the index of refraction curve are calculated from the experimental data. A purely analytic expression of the index of refraction is derived by a field matching method. Calculations show good agreement with test data. ***H. S. Kirschbaum and R. Tsu.*** *IRE Transactions on Microwave Theory and Techniques*, v. MTT-7, no. 1, Jan. 1959, p. 142-148. (TK1 In6.6mt Vis.)

5352 Design Considerations for High-Power Microwave Filters. A formula is derived that gives the relative power capacity of a waveguide filter of this type in terms of the bandwidth and cavity dimensions, and the element values of the low-pass prototype filter. Methods for eliminating spurious filter responses and of reducing the reflected energy are discussed. ***Seymour B. Cohn.*** *IRE Transactions on Microwave Theory and Techniques*, v. MTT-7, no. 1, Jan. 1959, p. 149-153. (TK1 In6.6mt Vis.)

5353 Evacuated Waveguide Filter for Suppressing Spurious Transmission From High-Power S-Band Radar. Describes a wave filter with *M*-derived terminations for impedance matching and with three sections including traps resonant in the stop band, for high attenuation. The filter provides over 120-db attenuation in the interference band. It is inserted in the antenna line of a search radar to suppress occasional oscillation in the spurious modes of a one-megawatt magnetron which turns over S band of 3.1 to 3.5 kmc and occasionally causes simultaneous interference in the band of 3.7 to 4.0 kmc. ***H. A. Wheeler and H. L. Bachman.*** *IRE Transactions on Microwave Theory and Techniques*, v. MTT-7, no. 1, Jan. 1959, p. 154-162. (TK1 In6.6mt Vis.)

5354 Hybrid Junction—Cutoff Waveguide Filters. Describes how low-pass and band-pass filter characteristics can be obtained in waveguide by the use of an arrangement of a waveguide hybrid junction and lengths of cutoff waveguide. Simple techniques are available for constructing filters of this type having variable cutoff frequencies and variable bandwidths. ***Eugene N. Torgow.*** *IRE Transactions on Microwave Theory and Techniques*, v. MTT-7, no. 1, Jan. 1959, p. 163-167. (TK1 In6.6mt Vis.)

5355 Practical Design of Strip-Transmission-Line Half-Wavelength Resonator Directional Filters. Describes the design procedure and the results of an experimental study of the strip-transmission-line resonator as an integral part of the directional filter utilizing direct and quarter-wave coupling between the half-wave resonants. ***R. D. Wanselow and L. P. Tuttle, Jr.*** *IRE Transactions on Microwave Theory and Techniques*, v. MTT-7, no. 1, Jan. 1959, p. 168-173. (TK1 In6.6mt Vis.)

5356* A New Component of the Solid State: The Zener Diode. Characteristics of germanium and silicon diodes in relation to intensity and tension. Static characteristics of the Zener silicon diodes Z6, Z7, and Z8. Temperature coefficient and internal dynamic resistance as function of the Zener tension for a 125 mW diode. Applications. (*In Spanish.*) Un nuevo componente del estado solido: el diodo Zener. ***C. Morgenroth.*** *Instituto Nacional de Electrónica, Revistva de Información Electronica*, v. 2, no. 5, Jan. 1959, p. 5-10.

5357* Gain, Bandwidth and Noise in a Cavity-Type Parametric Amplifier Using an Electron Beam. A study of the gain, bandwidth, and noise figure which can be expected in a cavity-type parametric amplifier using an electron beam. ***G. Wade and H. Heffner.*** *Journal of Electronics and Control*, v. 5, no. 6, Dec. 1958, p. 497-509.

5358* On the Lifetime and Diffusion Constant of the Injected Carriers and the Emitter Efficiency of a Junction Transistor. Values of the effective lifetime and of the apparent diffusion constant of the minority carriers in the base region of p-n-p alloy junction transistors of three different types have been determined. The analysis also yields separately the values of the volume and the surface recombination lifetimes. A method of estimating the emitter efficiency is also suggested. ***S. Deb and A. N. Daw.*** *Journal of Electronics and Control*, v. 5, no. 6, Dec. 1958, p. 514-530.

5359* The Cut-Off Characteristics of Magnetrons (Static Regime). The cut-off characteristic of a planar magnetron with a Maxwellian velocity distribution of the electrons is derived and with the help of this it is shown that inordinately high temperatures seem to prevail. Methods for improving the measurements of the gain are obtained. ***W. Fulop.*** *Journal of Electronics and Control*, v. 5, no. 6, Dec. 1958, p. 531-548.

5360* Measurement of Lifetime by the Photoconductive Decay Method. General equations have been derived for the decay of photo-injected carriers in a semiconductor with time for both steady-state and pulsed initial distributions. With high surface recombination velocities the loss of exponential nature of the decay leads to an error in the measured value of filament lifetime. This error has been found numerically and graphically for various lifetimes and penetration depths. ***B. K. Ridley.*** *Journal of Electronics and Control*, v. 5, no. 6, Dec. 1958, p. 549-558.

5361 Metallic Rectifiers and Crystal Diodes. This book is a compilation of the most useful basic information on metallic rectifiers and crystal diodes. It describes the manufacturing techniques employed in single-cell assembly and stacking methods, basic circuit design data, and testing procedures. The basic theory and construction of metallic rectifiers and crystal diodes, their varied applications and practical possibilities, are all discussed. ***Theodore Conti.*** Sections individually paged. 1958. John F. Rider Publisher, Inc., New York. (TK7872.S4 C76m)

5362* Signal Detection on the Background of Normal Noises and Chaotic Reflections. Considers the theory of optimal detection of radar signals in the presence of noises and reflections from chaotically distributed local objects. Intra- and inter-period processing of input signal is considered. (*In Russian.*) Obnaruzhenie signala na fone normal'nykh shumov i

khaoticheskikh. ***V. D. Zubakov.*** *Radiotekhnika i Elektronika*, v. 4, no. 1, Jan. 1959, p. 28-38.

5363* Selective Properties of Self-Oscillatory System Synchronized by a Harmonic Signal. Analysis of the behavior of a self-oscillatory system synchronized by a harmonic signal when the system is acted upon by an interfering quasi-harmonic emf. The action of harmonic and also of fluctuation interferences on the system is considered. (*In Russian.*) Izbiratel'nye svoĭstva avtokolebatel'noĭ sistemy, sinkhronizirovannoĭ garmonicheskim signalom. ***Iu. I. Samoilenko.*** *Radiotekhnika i Elektronika*, v. 4, no. 1, Jan. 1959, p. 39-42.

5364* Frequency Divider With Direct Capture. The theory of the frequency divider with direct capture is considered by the phase-pulse method, taking into account the effect of phase shift in the feedback circuit and the reaction of the anode on the operating conditions of the divider. The resutls of the experimental verification of the theory are described. (*In Russian.*) Delitel' chastoty s neposredstvennym zakhvatyvaniem. ***T. S. Fedosova and K. A. Samoilo.*** *Radiotekhnika i Elektronika*, v. 4, no. 1, Jan. 1959, p. 43-53.

5365* Analysis of the Performance of a Series Ionic Converter. Analysis of the performance of a series ionic converter which can be used as a source of higher-frequency current. Conditions are determined, under which a near-sinosoidal voltage curve can be obtained with ohmic load and stable operating conditions. (*In Russian.*) Analiz raboty posledovatel'nogo ionnogo preobrazovatelia. ***A. E. Slukhotskii, A. S. Vasil'yev, and V. M. Martsinovich.*** *Radiotekhnika i Elektronika*, v. 4, no. 1, Jan. 1959, p. 63-69.

5366* On Fluctuations of the Amplitude of Oscillations of a Self-Sustaining Tube Oscillator. Analysis of the relationship between "natural" fluctuations of the amplitude of tube oscillator and the increment, giving special attention to bifurcation points. Both mild and rigid conditions of self-excitation are investigated and, in the case of rigid operating conditions, the dependence of amplitude fluctuations in the region of hysteresis dependence of the amplitude upon decrement. (*In Russian.*) O fluktuatsiiakh amplitudy kolebaniĭ avtonomnogo lampovogo generatora. ***L. I. Gadzenko.*** *Radiotekhnika i Elektronika*, v. 4, no. 1, Jan. 1959, p. 97-108.

5367 Vacuum-Tube and Semiconductor Electronics. A fully integrated treatment of vacuum tubes and transistors is presented with three objectives: (1) explanation of physical behavior of devices, (2) integrate study of semiconductor devices with vacuum tubes, (3) to teach electronic circuit theory. ***Jacob Millman.*** 644 pp. 1958. McGraw-Hill, New York. (TK7872.V3 M62v)

See also: **5210** (semiconductor crystals); **5259** (electroless Cu plating in printed circuitry); **5271** (transient processes in thermistor circuit); **5278** (fading circuits); **5280** (scanner); **5539** (backscatter sounder); **5738** (electronic instruments for measuring machine-tool speeds); **5934** (semiconductors); **5972** (radomes).

ENGINEERING ECONOMICS

5368* A Stochastic Analysis of the Size Distribution of Firms. Investigation of trends in concentration and mobility of iron and steel firms in the U. S. ***Irma G. Adelman.*** *American Statistical Association, Journal*, v. 53, no. 284, Dec. 1958, p. 893-904.

5369* Approaches to National Output Measurement. Most problems in the conception and definition of output measurement can be handled by the use of consumer approach criteria. ***Paul B. Simpson.*** *American Statistical Association, Journal*, v. 53, no. 284, Dec. 1958, p. 948-962.

5370 What the Future Holds for Coal and Electricity. Forecasts the use of coal and electricity in the United Kingdom, based on statistics for 1958. *Engineering*, v. 187, Jan. 30, 1959, p. 144-145.

5371 The Engineering Industries in Europe. This report, which adopted by the Machinery Committee in January 1958, gives an account of the economic trends, and their principal causes, in the engineering industries of O.E.E.C. Member countries in the years 1955-1957. 297 pp. 1958. The Organisation for European Economic Co-Operation, Paris. (HC240.A1 Or3e)

5372* What Industry Is Spending Today for Maintenance. Presents findings on costs in 687 manufacturing companies. *Factory*, v. 117, Feb. 1959, p. 72-78.

5373* Now—A More Exact Cost Index. New method of estimating the price of lubricants in Factory's Cost Index. *Factory*, v. 117, Feb. 1959, p. 79.

5374* A Long Time Coming, But Now Those Unmeasurable Jobs Are Measurable. Here's an easy-to-use procedure that will measure work on your non-repetitive jobs. *Factory*, v. 117, Feb. 1959, p. 192 + 3 pages.

5375* How to Gage Maintenance Output. A uniform, simple approach to figuring performance on any maintenance job. ***A. M. Robinson.*** *Factory*, v. 117, Feb. 1959, p. 220 + 3 pages.

5376 The Iron and Steel Industry in Europe. Brings out the salient features of the situation during the period covered, and the main points to which attention should be paid by the industry in the immediate future. 146 pp. 1958. The Organisation for European Economic Co-Operation, Paris. (HD9525.A2 Or3i)

5377* Economics and Finance—The Roots of Corporate Enterprise. Discusses two questions: (1) Where does a corporation get its capital? and (2) how does it determine the best way to employ its capital? ***Charles F. Parker.*** *Journal of Petroleum Technology*, v. 11, Feb. 1959, p. 31-34.

5378* Chinks in the Iron Curtain. Gives production and import and export figures on metallic ores in Russia during 1956. *Metal Age*, 1959, no. 84, Jan., p. 1-2.

5379 Non Ferrous Metals Statistics. Production, Consumption, Foreign Trade Breakdown of Uses—1955-1957. Brings up to date, for the year 1957, the statistics published by the Non-Ferrous Metal Committee. It contains also the results of the study made by the Committee on metal uses at the first processing stage. (*In French and English.*) Statistiques des métaux non ferreux. Production, consommation, commerce extérieur répartition des usages—1955-1957. 131 pp. Sept. 1958, Organisation for European Economic Co-Operation, Paris. (TN758 Or3n)

5380 World Demand for General-Purpose Rubbers. Review giving some interesting new predictions on world rubber demands up to 1965. ***R. G. Stevens.*** *Rubber and Plastics Age*, v. 40, Jan. 1959, p. 32 + 4 pages.

See also: **5036** (chemical plant cost control); **5055** (size and costs of filter presses); **5232** (finishing operations control); **5419** (L.P.G. utilization in the occident); **5443** (Canadian and world mineral production—1958); **5472** (economics of pegmatites); **5482** (Italian extractive industries—1951); **5488** (Italian mineral industries—1955); **5512** (United Kingdom motor vehicle industry); **5517** (power supply in USSR); **5895** (recovery efficiency of jigs); **5900** (strategic minerals outlook); **6005** (world cotton economy).

FLUID MECHANICS

5381 Effect of Unequal Wall Roughness on Flow Between Flat Plates. ***H. N. McManus, Jr.*** *ARS Journal*, v. 29, Feb. 1959, p. 144-145.

5382 Scale of Separation Phenomena in Liquids Under Conditions of Nearly Free Fall. An estimate of the relative importance of the capillary (adhesion and cohesion) forces as compared to the gravitational or the (equivalent) inertial

forces acting on a liquid. ***E. T. Benedikt.*** *ARS Journal*, v. 29, Feb. 1959, p. 150-151.

5383* Axially Symmetrical Motion of Liquids. Exact analytical solution of equations of the axi-symmetrical flow around bodies symmetrical with respect to the axis of the pipeline. (*In Russian.*) K voprosu ob osesimmetrichnykh dvizheniiakh zhidkosti. ***D. Dumitresku.*** *Akademiia Nauk SSSR, Doklady*, v. 123, no. 6, Dec. 21, 1958, p. 963-966.

5384* On Flows Produced by Sound. Investigation of acoustic flow for Re $\gtrsim 1$ provoked by a saw-tooth wave. (*In Russian.*) K voprosu o potokakh, vyzvannykh zvukom. ***K. A. Naugol'nykh.*** *Akademiia Nauk SSSR, Doklady*, v. 123, no. 6, Dec. 21, 1958, p. 1003-1005.

5385* How Contamination Affects Servo Valve Design. Control by improved design. ***Richard E. Osgood.*** *Applied Hydraulics & Pneumatics*, v. 12, Feb. 1959, p. 79-82.

5386* A Radioactive Method of Measuring Low Water-Flow Rates. Describes a flowmeter designed for fluids at very low flow rates and at high pressure. ***J. F. Cameron, P. F. Berry, and F. Taylor.*** *British Chemical Engineering*, v. 4, Feb. 1959, p. 76-77.

5387 Interaction Between Two Equal-Sized Equal-Settling Spheres Moving Through a Viscous Liquid. Investigates the interaction at various distances between sphere centers and with the line of centers at various angles to the horizontal. ***G. F. Eveson, E. W. Hall, and S. G. Ward.*** *British Journal of Applied Physics*, v. 10, Jan. 1959, p. 43-47.

5388 New Viscosimeter for Continuous Determination of the Viscosity of Liquids. Principles of a viscosimeter for continuous and automatic control. ***Kh. Tashpulatov.*** *Henry Brutcher Translation No.* 4420, 4 pp. (From *Zavodskaya Laboratoriya*, v. 21, no. 5, 1955, p. 612-613.) Henry Brutcher, Altadena, Calif.

5389 How P & T Change Liquid Viscosity. ***Wallace R. Gambill.*** *Chemical Engineering*, v. 66, Feb. 9, 1959, p. 123-126.

5390 Viscosity and Self-Diffusion in Liquids. A modified rate-theory approach to the calculation of the transport coefficients of a liquid composed of spherically symmetric molecules. ***E. McLaughlin.*** *Faraday Society, Transactions*, v. 55, Jan. 1959, p. 28-38.

5391* The Mixing of Liquid or Gas Streams at Small Changes in Total Pressure. For the general case that the partial streams are of different densities, explicit solutions can be given whose range of validity depends on the change in total pressure during mixing. Approximate equations and graphical solutions allow for a rapid appraisal of efficiency and energy requirement of ejectors and similar equipment. (*In German.*) Vermischung von Flüssigkeits- oder Gasströmen bei kleiner Gesamtdruckänderung. ***E. Broecker.*** *Forschung auf dem Gebiete des Ingenieurwesens* (Ausgabe B), v. 24, no. 6, 1958, p. 169-177.

5392* A Contribution to the Problems of Flow Past Solid Bodies on the Basis of the Phenomenological Theory of Turbulance. A theoretical study of the problem of the flow of viscous liquids. (*In Russian.*) K postanovke zadachi obtekaniia v fenomenologicheskoĭ teorii turbulentnosti. ***V. G. Nevzgliadov.*** *Leningrad. Universitet. Vestnik*, v. 13, no. 19, 1958, p. 156-169.

5393* Lagrangian Formalism in Relativistic Hydrodynamics of Rotating Fluid Masses. The general theory of relativistic moving fluid masses is studied in terms of a new set of variables originally proposed by Einstein and Kramers. ***F. Halbwachs, P. Hillion, and J.-P. Vigier.*** *Nuovo Cimento*, v. 10, ser. 10, no. 5, Dec. 1, 1958, p. 817-833.

5394 New Method Simplifies Orifice-Meter-Chart Calculations. A new electronic computing typewriter can now make a chart calculation rapidly, verify, and automatically print out the results on the back of the chart together with all derivative factors, within 10 to 15 seconds. ***R. J. Enright.*** *Oil and Gas Journal*, v. 57, no. 8, Feb. 16, 1959, p. 138-140.

5395* Theoretical and Experimental Study of the Movement of Solid Bodies in a Fluid. The resistance R offered by the fluid to the movement of a solid body. The free movement of a spherical body of specific gravity ρ_s in a fluid at rest. (*In French.*) Etude théorique et expérimentale du mouvement des corps solides dans un fluide. ***R. J. Testut.*** *Revue de l'Industrie Minérale*, v. 51, Spec. Issue, Dec. 15, 1958, p. 45-57.

5396 Viscous Flow Round a Sphere at Low Reynolds Numbers (<40). The results of calculations made for $R = 5$, 10, 20, 40 are presented in the form of stream function and vorticity distributions; and further results of pressure distributions, velocity distributions, and drag coefficients, calculated from them. ***V. G. Jenson.*** *Royal Society, Proceedings*, v. 249, ser. A, Jan. 13, 1959, p. 346-366.

5397* Problems of a Boiling Layer Aerodynamics. Theoretical interpretation of the boiling of fine-grained material on the basis of this theory and experimental data presented. Formulae are derived for determining: the rate of beginning to boil, the resistance of boiling layer and its expansion, the current value of the porosity, the value of clear space, and the ratio of the rate of blowing to the rate of the beginning to boil. (*In Russian.*) Voprosy aerodinamiki kipiashchego sloia. ***V. M. Dement'ev.*** *Teploenergetika*, v. 6, no. 1, Jan. 1959, p. 50-56.

5398 The Molecular Structure of Liquids. Review of the statistical theories for the liquid state with special attention to the method of the radial distribution function, the cell theory, and recent Monte Carlo experiments. ***John S. Dahler.*** *U. S. Air Force, Wright Air Development Center, WADC Technical Report* 58-537, Oct. 1958, 48 pp. (TL507 Un3.18w Vis.)

5399 Investigation of Hastings Flowmeter for Measuring the Flow Rate of Uranium Hexafluoride. This instrument with certain changes could successfully measure the flow of UF_6. ***Donald J. Stoneking and Frederick M. Teetzel.*** *U. S. Atomic Energy Commission, NLCO-770*, Nov. 15, 1958, 21 pp. (UF767 Un3.1nL Contin.)

FOOD TECHNOLOGY

5400* Aerosol . . . Practical Food Package for Coming Space Travel. Pressurized packages can supplant conventional packages with great advantage for space travel. A low residue diet cutting down on fibrous waste output has been devised. Slightly overflavored food is necessary when pure oxygen is used in the sealed-in environment. Pressurized foods were listed and observations were made concerning their shelf life. ***Robert A. Nanz.*** *Aerosol Age*, v. 4, Feb. 1959, p. 26 + 4 pages.

5401* Wholesomeness of Irradiated Foods. Radiation preservation of foods, as currently practiced, is accomplished with the beam energies far below 10 million electron volts above which a measurable amount of radioactivity is induced. Foods treated at 3 and 6 million reps and stored at elevated temperature, will keep and have no deleterious effects on the growth of animals in short-term feeding experiments. Materials irradiated at dosages from 0.5 to 10 million reps, produced no irradiation induced carcinogens. ***Herbert Pollack.*** *American Dietetic Association, Journal*, v. 35, Mar. 1959, p. 235-240.

5402 The Chemical Analysis of Foods and Food Products. An enlargement of the two previous editions, this book gives a systematic coverage to the salient facts and of certain new aspects of food analysis such as the chemical assay of vitamins, the detection of improper pasteurization of milk, the detection of milk, etc., but especially in this edition, covers such aspects as the development and enforcement of standard of identity, purity or value, the problems of decomposition under normal or abnormal storage conditions, the determination of the nutritive value of foods for scientific, dietary or labeling purposes, etc. ***Morris B. Jacobs.*** 3rd Ed. 970 pp. 1958. D. Van Nostrand Co., Princeton, N. J. (QD131 J15c3)

5403* Radiation Preservation of Milk and Milk Products. VIII. Radiation-Distillation Apparatus for Using High Energy Electrons. ***J. H. Wertheim, et al.*** *Food Technology*, v. 13, Feb. 1959, p. 94 + 2 pages.

5404* Ultrasonic Defrosting of Frozen Foods. The relatively high energy requirements to achieve reasonable thawing rates in liquid foods and negligible effects in solid foods indicate inherent limitations of ultrasonic thawing. The use of ultrasonic energy to defrost frozen foods does not appear to be feasible because internal heating is difficult to realize, and existing equipment and power costs are not attractive in comparison with costs of conventional procedure. ***A. L. Brody and J. N. Antonevich.*** *Food Technology*, v. 13, Feb. 1959, p. 109-112.

5405* The Effect of Several Antifungal Antibiotics on the Growth of Common Food Spoilage Fungi. Antifungal antibiotics arranged in order of decreasing effectiveness in producing complete inhibition of the test fungi are myprozine, rimocidin, nystatin, fungizone, actidione, and griseofulvin. Of the fungi tested, *Absidia sp.* was the most resistant to the inhibitory action of the test antibiotics, while *Sclerotinia fructicola* and *Botrytis cinera* appeared to be the least resistant. ***John B. Klis, Lloyd D. Witter, and Z. John Ordal.*** *Food Technology*, v. 13, Feb. 1959, p. 124-128.

5406* Application of Flavor Enzymes to Processed Foods. I. Panel Studies. Adding flavor enzymes to processed foods and to flavor precursor solutions influences the flavor strongly. The preference ratings show, in addition, a decisive preference for the enzyme-treated samples over the untreated controls. ***Kurt S. Konigsbacher, Eric J. Hewitt, and Ralph L. Evans.*** *Food Technology*, v. 13, Feb. 1959, p. 128 + 3 pages.

5407 Biological Value of Gamma Irradiated Corn Protein and Wheat Gluten. Irradiation did not produce off-flavors or odors in corn or wheat gluten; the lysine in corn or wheat gluten and the tryptophan in corn were not destroyed. Radiation-sterilized corn and wheat gluten were completely acceptable for the growing rat during a 20-day feeding period. Irradiation, like heat-cooking, did not affect the digestibility of corn protein or the digestibility of wheat gluten. The biological value of corn protein and of wheat gluten were also not affected. ***V. Chalam Metta and B. Connor Johnson.*** *Journal of Agricultural and Food Chemistry*, v. 7, Feb. 1959, p. 131-133.

5408 Further Studies on the Ionizing Radiation Inactivation of Bacterial Spores. Previous observations showing that there are two classes of radiation inactivation for bacterial spores are extended to germinating forms. Spores which inactivate in a "multiple target" fashion inactivate in a "two target" fashion upon germination, whereas spores which inactivate in a "single target" fashion inactivate in a "single target" fashion upon germination. Spores of the "multiple target" class seem to have a higher content of dipicolinic acid per g of dry spore material than do those of the "single target" class. ***Carl Woese.*** *Journal of Bacteriology*, v. 77, no. 1, Jan. 1959, p. 38-42.

5409 The Fatty Acids of Blood. The fatty acids of blood are present in esterified form as glycerides, phospholipids and cholesterol esters in the form of lipoprotein complexes. Unesterified fatty acids are found as a very small fraction of the total lipids in most species, but in appreciable amounts (especially in the form of acetate) in the blood of ruminants. Recent investigations on the transport of fatty acids of exogenous and endogenous origin are described and the possible metabolic importance of unesterified, higher fatty acids is discussed. ***G. A. Garton.*** *Journal of the Science of Food and Agriculture*, v. 10, Jan. 1959, p. 12-19.

5410 Effects of Gamma-Radiation on Some Carbohydrates, Hydroxyacids and Amino-Acids in Aqueous Solutions. ***S. A. Barker, P. M. Grant, M. Stacey, and R. B. Ward.*** *Nature*, v. 183, Feb. 7, 1959, p. 376-377.

5411* Packaging Effects on the Flavor and Shelf Life of Gamma-Irradiated Fresh Fruits and Vegetables. The can-lining materials such as saran, parchment, cellophane, Mylar, and DuPont's experimental film No. 322, may have more possibility to be used during the irradiation process than other materials used. The success of the preservation of the irradiated fresh fruits and vegetables will depend upon the availability of a semi-permeable film which will allow normal respiration of the product and at the same time will prohibit the entry of microbes. Aeration, during irradiation of fruits and vegetables, is essential to extend the shelf life as well as to retain the natural flavor of fresh fruits and vegetables by supplying O_2 for the normal respiration process and at the same time removing CO_2 and other gases given out as a result of respiration and of radiation. ***D. K. Salunkhe, L. H. Pollard, R. K. Gerber, Ethelwyn B. Wilcox, and Morris Simon.*** *Package Engineering*, v. 4, Feb. 1959, p. 40 + 10 pages.

See also: **5650** (corrosion in cooking utensils).

FUELS AND COMBUSTION

5412 Improvements in the Operating Characteristics of n-Propyl Nitrate. Summarizes chemical aspects of work done in the development of a gas generator using n-propyl nitrate. ***R. W. Lawrence and W. P. Knight.*** *ARS Journal*, v. 29, Jan. 1959, p. 29-32.

5413 The Ignition Behavior of Various Amines With White Fuming Nitric Acid. Spontaneous ignitibility depends on synergetic behavior of several reactions, each of which exerts its greatest independent influence at a different time during the ignition period. Mixing which is too rapid can quench ignition if the mixture ratios, favoring the various reactions leading to ignition, are too widely separated. ***Rose L. Schalla and Edward A. Fletcher.*** *ARS Journal*, v. 29, Jan. 1959, p. 33-39.

5414* The Process of Fissuring in Coke and the Mechanism of Coke Formation. ***Julian Nadziakiewicz.*** *Coke and Gas*, v. 21, Feb. 1959, p. 46-55.

5415 The Recombination of Hydrogen Atoms and Hydroxyl Radicals in Hydrogen Flame Gases. The recombination of the free radicals H and OH in the burnt gases of H + O + N burner flames at atmospheric pressure has been examined by flame photometric methods for temperatures in the range 1600-2400 K. ***E. M. Bulewicz and T. M. Sugden.*** *Faraday Society, Transactions*, v. 54, Dec. 1958, p. 1855-1860.

5416 Chemical Structure and Properties of Coal. XXI. The Kinetics of Coal Carbonization. Determines the flow rate of each of the gases concerned under a vacuum at rising temperature by measuring the flow rates of all the gases, and frequent gas analysis. ***D. Fitzgerald and D. W. Van Krevelen.*** *Fuel*, v. 38, no. 1, Jan. 1959, p. 17-37.

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5418* Thermal Softening and Decomposition of Coals and Their Relations to Coke Formation. Characteristic behavior of coking coals on heating. Influence of fissures on the drum strength of coke. Best combination of coals in blending in order to produce hard cokes from high volatile domestic coals. ***Yuji Yoshida.*** *Fuel Society of Japan, Journal*, v. 37, no. 379, Nov. 1958, p. 617-627.

5419* Utilization of L.P.G. in the Chemical Industries. Present status of L.P.G. and natural gas in U. S. A., England, Italy and Germany. Profitable utilization processes. (*In Japanese.*) ***Masahiko Oka.*** *Fuel Society of Japan, Journal*, v. 38, no. 380, Dec. 1958, p. 664-667.

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faces. ***Welby G. Courtney.*** *Jet Propulsion*, v. 28, Dec. 1958, p. 836-839.

5423 Fuel Cells. Types, thermodynamics, and applications. ***G. J. Young and R. B. Rozelle.*** *Journal of Chemical Education*, v. 36, Feb. 1959, p. 68-73.

5424* High Energy Composite Propellant Systems. Ballistic characteristics, mechanical properties, and processability of fuels. ***Karl Klager.*** *Missile Design and Development*, v. 5, Feb. 1959, p. 16 + 2 pages.

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See also: **5024** (fluorine chemistry and technology); **5057** (C_2H_2 and C_2H_4 from petroleum hydrocarbons); **5066** (petroleum processing); **5181** (burning rate of hydrocarbons); **5891** (improving coking coal quality); **5902** (bituminous coal cleaning).

GEOLOGY, GEOPHYSICS, MINERALOGY, AND MINING ENGINEERING

5432 Drilling by Vibration. An analysis of the process of vibratory drilling, based on the assumption that the load presented by the bit vibrating on the rock to the vibration generator, a magnetostriction transducer, can be represented by a force-displacement characteristic with hysteresis. Conclusions are compared with experimental observations on the performance of vibratory drilling systems. ***R. Simon.*** *ASME, Transactions, Series B, Journal of Engineering for Industry*, v. 81, no. 1, Feb. 1959, p. 67-76.

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5439* Geologic Architecture of Circum-Pacific. Outlines the above in terms of development of the mobile belt. ***Lewis G. Weeks.*** *American Association of Petroleum Geologists, Bulletin*, v. 43, Feb. 1959, p. 350-380.

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5444* Rocket Experiments to Determine the Composition of the Upper Atmosphere. Ejection of chemicals in the upper atmosphere and observation of characteristic chemiluminescences. ***H. I. Schiff.*** *Chemistry in Canada*, v. 11, Feb. 1959, p. 27-29.

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5447* Overshot Closure Device Can Stem Flow From Wild Well. A combination wrap-around and overshot closure device. ***W. E. Harrelson and John E. Ortloff.*** *Drilling*, v. 20, Feb. 1959, p. 75-76.

5448* Additive Controls Fluid Loss During Formation Fracture. Fracture treatment in bromide sand formation, Garvin County, Oklahoma. ***Bob W. Hughes.*** *Drilling*, v. 20, Feb. 1959, p. 77.

5449* Vibration Drilling Gets Further Study. Drilling by vibration is accomplished by superimposing longitudinal vibrations onto the drill bit of an otherwise conventional rotary drilling system. A number of laboratory and field models of vibratory drilling machines have been designed, constructed, and used experimentally. The latest version encompasses a magnetostriction transducer that follows a 10¾-in. rotary bit down the hole. It is tentatively concluded that vibratory drilling in rock of medium hardness may be just about economically competitive with conventional drilling. ***Ralph Simon.*** *Drilling*, v. 20, Feb. 1959, p. 110.

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take place inside the opening, not on its face. Fifteen pounds of lost circulation material per barrel of mud is about the optimum. Materials are more effective if a waiting period is used. ***B. Q. Green.*** *Oil and Gas Journal*, v. 57, no. 10, Mar. 2, 1959, p. 110 + 3 pages.

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5488 Statistics Concerning the Mines, Quarries and Pits for 1955. Production, Labor, Motive Power, Accidents and Movement of the Research Permits, Mines in Existence and Activity. (*In Italian.*) Statistica delle miniere, cave e torbiere per l'anno 1955. Produzione, manodopera, forza motrice, infortuni e movimento dei permessi di ricerca, miniere esistenti e loro stato di attivita. 159 pp. 1957. Italian Department of Industry and Commerce, Rome. (TN79 It1.5s)

5489 Zirconium and Hafnium in the Southeastern Atlantic States. Zircon resources of Florida and other areas in the Coastal Plain province with a discussion of the origin of this mineral. ***John B. Mertie, Jr.*** *U. S. Geological Survey Bulletin* 1082-A, 1958, 28 pp. (QE75 Un3b Contin.)

5490 Summary of Statistical Icing Cloud Data Measured Over United States and North Atlantic, Pacific, and Arctic Oceans During Routine Aircraft Operations. ***Porter J. Perkins.*** *U. S. National Aeronautics and Space Administration, NASA Memorandum* 1-19-59E, Jan. 1959, 89 pp. (TL782 Un3rm Vis.)

5491* Ionization of Air by H^+ and H_2^+ Ions. The composition of the secondary ions produced in single collisions between 5–180 keV H^+ and H_2^+ ions and air molecules has been studied. The following secondary ions have been detected: N_2^+, O_2^+, N^+, O^+, N^{++}, O^{++}, and Ar^+. The cross sections for secondary ion formation and also the cross section for electron capture by H^+ and H_2^+ ions and total cross section for ionization of air have been measured. (*In Russian.*) Ionizatsiia vozdukha ionami H^+ i H_2^+. ***R. N. Il'in, V. V. Afrosimov, and N. V. Fedorenko.*** *Zhurnal Eksperimental'noĭ i Teoreticheskoĭ Fiziki*, v. 36, no. 1, Jan. 1959, p. 41-48.

See also: **4890** (retardation of a satellite); **5102** (analysis of chlorite minerals); **5798** (carbide rock drills); **5841** (survey of raw materials resources).

GRAPHIC ARTS

5492 Continuous Printers Complete Unitized Microfilm System. Describes a unitized microfilm system consisting of camera equipment to reduce original drawings into microfilm form. Punched sort cards which contain the microfilm image in an aperture frame and which can be sorted and filed automatically, and enlarging and printing equipment to make enlarged prints of the microfilm image. *Industrial Laboratories*, v. 10, Feb. 1959, p. 109-110.

5493* Electronic Scanning Methods for Colour Printing. The basic problem of scientific color correction and the essential requirements of any color scanner are considered. All known color scanners are described, and their technical development is outlined. ***G. S. Allen.*** *Journal of Photographic Science*, v. 6, no. 5, Sept.-Oct. 1958, p. 125-140.

5494* Relationships Between Optimal Exposure Characteristics of Photographic Materials. Shows first that the rate of absorption giving maximum efficiency is largely independent of sensitivity among the grains of a single emulsion, and second, that the rate of absorption of quanta-unit volume of silver halide giving maximum efficiency is independent of grain size. ***G. C. Farnell.*** *Journal of Photographic Science*, v. 6, no 5, Sept.-Oct. 1958, p. 141-143.

5495* Evaluation of Lens Distortion by Visual and Photographic Methods. For each method, values can be obtained that are precise to within ± 4 microns. When proper care is taken, the values obtained by either of the methods do not depart from the common average by amounts exceeding ± 5 microns. ***Francis E. Washer, William P. Tayman, and Walter R. Darling.*** *Journal of Research, National Bureau of Standards*, v. 61, no. 6, Dec. 1958, p. 509-515.

See also: **5229** (flexographic inks); **5249** (packaging inks for film and foil); **5992** (graphic arts ventilation).

HEAT POWER

5496 A Ballistic Bomb Method for Determining the Experimental Performance of Rocket Propellants. A method devised for the determination of measured performance values

of rocket propellants without the requirement of actual rocket motor operation. ***Donald N. Griffin, Charles F. Turner, and George T. Angeloff.*** *ARS Journal*, v. 29, Jan. 1959, p. 15-19.

5497 Surveillance of Solid Propellant Rockets. Deterioration processes. Accelerated and long-term aging. ***Carl Boyars.*** *ARS Journal*, v. 29, Feb. 1959, p. 148-150.

5498* Rover Diesel Engine. Two-litre indirect injection unit for application in cross-country vehicles. *Automobile Engineer*, v. 49, Feb. 1959, p. 42-48.

5499 20 Million lb. Thrust Engine Foreseen. Preview. ***Michael Yaffee.*** *Aviation Week*, v. 70, Feb. 9, 1959, p. 51 + 4 pages.

5500 Fuel Cells. Low- and high-temperature fuel cells. Potential application of the latter. ***Everett Gorin and Howard L. Recht.*** *Blast Furnace and Steel Plant*, v. 47, Feb. 1959, p. 206-209.

5501* Sea Cow. The mass production of outboards in Canada is detailed. The role played by pneumatic tools and compressed air is outlined. ***J. P. Smallwood.*** *Compressed Air Magazine*, v. 64, Feb. 1959, p. 16-19.

5502* Onan DRN 15 HP Diesel. In addition to small engines, Onan also introduces eight new series of Diesel-driven generating sets from 50 to 200 KW. *Diesel and Gas Turbine Progress*, v. 25, Mar. 1959, p. 40-41.

5503* 12,000 HP Model W-121 Gas Turbine. Westinghouse Electric Corp. produces its largest gas turbine; multistage unit will be installed in steel mill in Mexico. ***R. Tom Sawyer.*** *Diesel and Gas Turbine Progress*, v. 25, Mar. 1959, p. 46-47.

5504* Non-Uniform Burning in a High Speed Parallel Sided Combustor. II. A fundamental review of the problem in terms of one-dimensional reasoning, adopted on the grounds that its admitted inadequacies in detail are heavily compensated by its manageability in numerical analysis over a wide range of variables. Three flow models are proposed and examined; specimen calculations are given at all stages. ***Boris N. Cole.*** *Engineer*, v. 207, Jan. 23, 1959, p. 129-132.

5505* Engines at the National Boat Show. Description and specifications of engines for powering small craft. *Engineer*, v. 207, Jan. 30, 1959, p. 183-185.

5506* Acceptance Tests on Steam Turbines. Results and experience with special attention to industrial turbines. ***R. Hohl.*** *Escher Wyss News*, v. 31, no. 2, 1958, p. 15-29.

5507* Fuel Cells. Long-lived high-output fuel cells can be devised which give a thermal efficiency of 70% for the direct generation of electric power from fossil fuels. ***Everett Gorin and Howard L. Recht.*** *Gas Age*, v. 123, Feb. 5, 1959, p. 38-40.

5508* A Versatile Fuel Injection Pump. Description of a distributor-type fuel injection pump introduced by C.A.V. Ltd. which has become standard equipment on a number of well-known engines. *Gas and Oil Power*, v. 54, Jan. 1959, p. 3-8.

5509* Supercharge for a Pressure-Fired Boiler. An 11-stage axial-flow compressor, supplying 40,000 c.f.m. air at a pressure ratio of 4.5 with inlet conditions 14.7 lb. per sq. in., 100 deg. F, is driven by a 6,100 h.p. integrally-cased two-stage gas turbine with boiler exhaust gas at 61.2 lb. per sq. in., 815 F. ***R. C. Reisweber, J. W. Glessner, and J. R. Shields.*** *Gas and Oil Power*, v. 54, Jan. 1959, p. 16-18.

5510* Design Features of New Large Gas Turbines for Power Generation. The 16,500 and 21,800 - kw units. ***A. O. White.*** *Gas and Oil Power*, v. 54, Jan. 1959, p. 22-25.

5511* Improved Diesel Engine Provides Increased Fuel Economy. Detroit Diesel Engine Division designed and developed a new engine series, the 71-E, based on the existing Series 71. The engine has improved fuel economy, longer life, and equal power with the standard Series 71 engine and a high degree of parts interchangeability with the Series 71 engine. ***Harry S. Ford, Jr. and John J. May.*** *General Motors Engineering Journal*, v. 6, no. 1, Jan.-Feb.-Mar. 1959, p. 6-11.

5512 The United Kingdom Motor Vehicle Industry. The present organization, output, and methods of the U.K. industry and its past, present, and possible future markets both at home and overseas. ***Eric Woodbridge.*** *Institute of Petroleum Review*, v. 13, Jan. 1959, p. 1-3.

5513 Design and Development of Four Light-Weight High-Speed Marine Gas Turbines for Electric Generator Drive. Brief description of the most important features of these engines, and problems that were encountered during their design and development. ***A. W. Pope.*** *Institution of Mechanical Engineers, Proceedings*, v. 172, no. 8, 1958, p. 301-319 + 3 plates.

5514 Experimental Studies of the Mixing Processes and Flow Configurations in Two-Cycle Engine Scavenging. *W. Rizk.* *Institution of Mechanical Engineers, Proceedings*, v. 172, no. 10, 1958, p. 417-438 + 4 plates.

5515* Multi-Unit Steam Generators. Discusses the case for the use of a large number of comparatively small heat exchangers, as in the French reactor EDF1, in contrast to established British practice. ***W. B. Sallitt.*** *Nuclear Engineering*, v. 4, Feb. 1959, p. 66-68.

5516 Engine Analyzer Spots Trouble in the Making. This electronic instrument can test ignition, vibration, and pressure, and indicate adjustments to permit more efficient gas-engine operation. ***M. G. Wallington.*** *Oil and Gas Journal*, v. 57, no. 8, Feb. 16, 1959, p. 133-135.

5517* Ways of Power Supply Development in the U.S.S.R. Trends and outlooks. (*In Russian.*) Puti razvitiia energetiki v SSSR. ***G. A. Matveev.*** *Priroda*, v. 48, no. 1, Jan. 1959, p. 73-82.

5518* Detailed Tests of Gas Turbine Groups Fed by Blast Furnace Gas. (*In French.*) Essais détaillés de groupes turbines a gaz alimentés en gaz de haut fourneau. ***André Jaumotte and Jean Baland.*** *Revue Universelle des Mines*, v. 102, ser. 9, Jan. 1959, p. 3-18.

5519 Rocket Propellants—The Key to Space Travel. II. Liquid fuels and other methods of rocket propulsion, some of them unconventional and speculative. ***Frederick I. Ordway, III.*** *Sky and Telescope*, v. 18, no. 5, Mar. 1959, p. 244-248.

5520 Structural Design and Preliminary Evaluation of a Lightweight, Brazed, Air-Cooled Turbine Rotor Assembly. *André J. Meyer, Jr. and William C. Morgan.* *U. S. National Aeronautics and Space Administration, NASA Memorandum* 10-5-58E, Dec. 1958, 25 pp. (TL782 Un3rm Vis.)

5521 Comparison of Calculated and Experimental Total-Pressure Loss and Airflow Distribution in Tubular Turbojet Combustors With Tapered Liners. *Jack S. Grobman.* *U. S. National Aeronautics and Space Administration, NASA Memorandum* 11-26-58E, Jan. 1959, 48 pp. (TL782 Un3rm Vis.)

5522 Performance of Typical Rear-Stage Axial-Flow Compressor Rotor Blade Row at Three Different Blade Setting Angles. *Marvin I. Kussoy and Daniel Bachkin.* *U. S. National Aeronautics and Space Administration, NASA Memorandum* 11-27-58E, Jan. 1959, 37 pp. (TL782 Un3rm Vis.)

5523 Propellant Vaporization as a Criterion for Rocket-Engine Design; Experimental Performance, Vaporization, and Heat-Transfer Rates With Various Propellant Combinations. *Bruce J. Clark, Martin Hersch, and Richard J. Priem.* *U. S. National Aeronautics and Space Administration, NASA Memorandum* 12-29-58E, Jan. 1959, 31 pp. (TL782 Un3rm Vis.)

5524 Effect of Stator and Rotor Aspect Ratio on Transonic-Turbine Performance. Experimental investigation. ***Robert Y. Wong and Daniel E. Monroe.*** *U. S. National Aeronautics and Space Administration, NASA Memorandum* 2-11-59E, 27 pp. (TL782 Un3rm Vis.)

See also: **5133** (boron technology); **5581** (lubrication of large gas turbine).

INFORMATION—PREPARATION AND DISSEMINATION

5525* Three Levels of Linguistic Analysis in Machine Translation. A general analysis technique for solving machine translation problems, has been developed for Russian-English translation. Reports the techniques, and results of several test runs on the IBM 705, of the General Analysis Technique. A three-stage program is described and linguistic explanations for these steps are provided. ***Michael Zarechnak.*** *Association for Computing Machinery, Journal*, v. 6, no. 1, Jan. 1959, p. 24-32.

5526 English, The Universal Technical Language? The present status of English, as a technical language is examined, as well as the forces tending to spread, or diminish, its utilization. But the future growth of Russian—and Chinese—is the chief unknown. ***Edwin Holmstrom.*** *Engineering*, v. 187, Feb. 6, 1959, p. 168-169.

5527* Fact or Fantasy? Russia's Book Production. UNESCO figures cited to prove Soviet is world's largest publisher and consumer; plant examination leaves room for discussion. ***John E. Felber.*** *Book Production*, v. 69, no. 2, Feb. 1959, p. 47-48.

5528* Information Retrieval: A Pragmatic Approach. Subject index used by Imperial Chemical Industries, Paints Division's Library & Information Service is described. The index itself consists of 13 by 9 in. leaves contained in a number of loose-leaf binders. Each leaf is ruled in double-columns (one side only) and references from the Service's various bulletins are cut up and pasted in. Each page, when full, contains about ten references, and the scanning speed is about twice that for cards. ***D. V. Arnold.*** *Journal of Documentation*, v. 14, no. 4, Dec. 1958, p. 183-189.

5529* The Analysis of Reference Question Records as a Guide to the Information Requirements of Scientists. ***P. F. Cole.*** *Journal of Documentation*, v. 14, no. 4, Dec. 1959, p. 197-207.

5530 The Art of Specification Writing. ***Paul W. Franklin.*** *Military Electronics*, v. 6, Jan. 1959, p. 14-15.

5531 Find That Data. A description of Convair-Pomona's Engineering Standards Group's use of punched-card coordinate indexing to locate useful data. ***A. J. Chippendale, Jr. and D. W. Snyder.*** *Military Electronics*, v. 6, Jan. 1959, p. 16-19.

5532 Verbal Communications in Missile Engineering. The establishment of clearly defined terms to be used in the reliability program will not, *per se*, result in a more reliable product. However, problems can best be solved when they are fully understood and quantitatively defined. ***A. N. Benson.*** *Military Electronics*, v. 6, Feb. 1959, p. 4 + 2 pages.

5533* How Is it Possible to Cover the Published Information Related to the State of Technology Today? Basic Ideas Concerning the Patent Research Problem. According to the authors it is no longer possible for the patent examiners today to thoroughly know the state of technology without using memory computers. Machine punch cards as computing means for patent research were especially studied. (*In German.*) Wie ist heute die Erfassung des literarisch gegebenen Standes der Technik noch möglich? Grundgedanken zu dem Problem der Patentrecherche. ***Erich Meyer and Willy Heimerdinger.*** *Nachrichten für Dokumentation*, v. 9, no. 4, Dec. 1958, p. 172-179.

5534* English as a World Language. Many writers ignore the special problem of readers whose native tongue is not English. Ornate Latinisms and involved sentences are a needless barrier to understanding. ***R. A. Close.*** *New Scientist*, v. 5, Jan. 22, 1959, p. 184-186.

See also: **4984** (Bibliography of Space Medicine).

INSTRUMENTATION

5535* Problems of Measuring Uncertainty, Accuracy and Sensitivity. The generally accepted definition of measuring accuracy is considered incorrect by the survey and instead, it is suggested, to call its reciprocal value—accuracy. Finally, the connection between accuracy and sensitivity is dealt with in an example. ***V. Uray.*** *Acta Technica Academiae Scientiarum Hungaricae*, v. 22, nos. 3-4, 1958, p. 311-327.

5536 Particle Size Analysis by Gamma-Ray Absorption. Accurate particle size analyses of uranium oxide were obtained by a γ-ray absorption method. ***Charles P. Ross.*** *Analytical Chemistry*, v. 31, Mar. 1959, p. 337-339.

5537* Measuring Temperature in Small Space. Subminiature devices can employ thermistors to advantage as primary elements in precise temperature measurements. They replace thermocouples, thermometers or frequency calibrated crystals. Favoring thermistors are small size, extreme sensitivity and rapid response. The case history described will suggest other applications. ***Frank J. Cheli.*** *Electronic Equipment Engineering*, v. 7, Feb. 1959, p. 43-44.

5538 Continuous Contour Control Systems. A survey of continuous contour control systems. *Engineers' Digest*, v. 20, Jan. 1959, p. 5-32.

5539* The IGY Three-Frequency Backscatter Sounder. Design criteria and operating characteristics of the IGY fixed-frequency backscatter sounder are outlined. This three-frequency (12, 18, and 30 mc) rotating-antenna pulse sounder was designed at Stanford University for oblique-incidence ionosphere studies. ***A. M. Peterson, R. D. Egan, and D. S. Pratt.*** *I.R.E. Proceedings*, v. 47, Feb. 1959, p. 300-314.

5540* The Riometer—A Device for the Continuous Measurement of Ionospheric Absorption. A sensitive, self-balancing, noise-measuring equipment, known as the riometer, is described. This instrument has been designed for routine measurement of ionospheric absorption during the IGY, using the cosmic noise method. ***C. G. Little and H. Leinbach.*** *I.R.E. Proceedings*, v. 47, Feb. 1959, p. 315-320.

5541* A Controller to Overcome Dead Time. This new type control produces high-grain, precise regulation of loops containing long dead-times, yet without sacrificing stability. ***Otto J. M. Smith.*** *ISA Journal*, v. 6, Feb. 1959, p. 28-33.

5542* "Integral Accuracy" Electronic Instruments. Considers electronic instruments which are now being built with inherent accuracy. Discusses new test instrumentation and data-handling systems which have no need for calibration. ***Noel B. Braymer and William D. Bell.*** *ISA Journal*, v. 6, Feb. 1959, p. 42-46.

5543* New Strain Gages for the Space Age. Describes two new strain gages developed by NBS which will work in the temperature range from 1000 to 2000 F. *ISA Jorunal*, v. 6, Feb. 1959, p. 50-51.

5544* Pressure Gage With a Sensing Unit of the Aneroid-Electrical Type. Description of a constructed and tested apparatus for measuring absolute pressure. The apparatus has a sensing element with wire tension sensing head and incorporates an automatic numerical recording on a punched paper tape. (*In Russian.*) Izmeritel' davleniia s datchikom aneroidno-elektricheskogo tipa. ***M. B. Maizel'.*** *Izmeritel'naia Tekhnika*, 1959, no. 1, Jan., p. 13-16.

5545* Measuring Devices With Magnetic Bridges. Description of the operating principles and of the results of tests of measuring devices using magnetic bridges. (*In Russian.*) Izmeriteli s magnitnymi mostami. ***N. F. Subid.*** *Izmeritel'naia Tekhnika*, 1959, no. 1, Jan., p. 33-36.

5546 Impaction Sampler for Size Grading Air-Borne Bacteria-Carrying Particles. A sampler for air-borne bacteria is described which separates the sample into four fractions, each collected on to the agar surface of a Petri dish. The sampling rate is approximately 20 ft 3/min., the size limits to the fractions are, above 18μ diameter, between 10 and 18μ, between 10 and 4μ, and below 4μ. ***O. M. Lidwell.*** *Journal of Scientific Instruments*, v. 36, Jan. 1959, p. 3-8.

5547 X-Ray Analysis Technique for Very High Temperatures. A new powder-diffraction technique for very high temperatures is described, in which a thermocouple combines the

functions of sample support, heating, and temperature measurement. The maximum working temperature depends on the thermocouple material, and is normally 1750 C using 5/20 rhodium-platinum, or 1850 C with 20/40 rhodium-platinum couples. ***E. Aruja, J. H. Welch, and W. Gutt.*** *Journal of Scientific Instruments*, v. 36, Jan. 1959, p. 16-20.

5548 Low Background Gas Flow-Counter. A low background flow-counter of comparatively simple construction, operating in the Geiger region, is described. The sample counter is shielded by mercury and surrounded by an anti-coincidence ring of eighteen overlapping counters, a top counter, and lead and mercury shields. The counter efficiency with 1 in. diameter steel planchets is 62% for low energy β particles such as ^{14}C; the background is 1.040 ± 0.005 counts/min; and the limit of sensitivity is 0.025 counts/min. ***G. H. Bergold and G. R. Haney.*** *Journal of Scientific Instruments*, v. 36, Jan. 1959, p. 39-44.

5549* Multi-Channel Pair Gamma-Spectrometer. I. Calculation of Basic Characteristics of a Gamma-Spectrometer. II. Description of a 12-Channel Spectrometer. Describes the results of the calculation of the resolving capacity and efficiency of a spectrometer. A basis is given for selecting the optimal geometry of a multi-channel system. Describes 12-channel magnetic pair spectrometer used for investigating γ-radiation appearing with decay of neutral π-mesons generated in a synchrocyclotron. The apparatus permits measurement of energy spectra of γ-quanta in the range from 20 to 600 Mev. (*In Russian.*) Mnogokanal'nyĭ Parnyĭ Gamma Spektrometr. I. Raschet osnovnykh kharakteristik gamma-spektrometra. II. Opisanie dvenadtsatikanal'nogo spektrometra. ***Iu. D. Baiukov, M. S. Kozodaev, A. A. Markov, A. N Sinaev, and A. A. Tiapkin.*** *Pribory i Tekhnika Eksperimenta*, 1958, no. 6, Nov.-Dec., p. 23-40.

5550* Investigation of Electron Focusing in a Spiral Spectrometer. Describes the results of an experimental investigation of the behavior of electron beam in various regions of the magnetic field. Dispersion, resolving capacity, and light-gathering power were determined photographically. The data obtained make it possible to select the optimal conditions for the operation of a given spectrometer. (*In Russian.*) Issledovanie fokusirovki elektronov v spiral'nom spektrometre. ***A. V. Gnedich, L. N. Kriukova, V. V. Murav'eva, and V. I. Shumshurov.*** *Pribory i Tekhnika Eksperimenta*, 1958, no. 6, Nov.-Dec., p. 41-45 + 1 plate.

5551* High-Pressure Diffusion Chamber in Pulse-Magnetic Field. Describes an installation with a high-pressure diffusion chamber intended for work with a beam of particles produced in a synchrocyclotron. The chamber is designed for light gases (H_2, D_2, and He) at the pressure of up to 25 atm. The magnetic field in the sensitive volume reaches 11,200 and 10,000 oersteds under continuous and pulse operating conditions, respectively. (*In Russian.*) Diffuzionnaia kamera vysokogo davleniia v impul'snom magnitnom pole. ***M. S. Kozodaev, M. M. Kuliukin, R. M. Suliaev, A. I. Filippov, and Iu. A. Shcherbakov.*** *Pribory i Tekhnika Eksperimenta*, 1958, no. 6, Nov.-Dec., p. 47-55.

5552* Coincidence Circuit With Small Resolving Time. Description of a simple coincidence circuit with the resolving time of a millimicrosecond range. The circuit can be used in physical investigations connected with counting of elementary particles. The circuit requires no leveling of amplitudes and can be used for detecting particles with a wide energy spectrum. (*In Russian.*) Skhema sovpadeniĭ s malym razreshaiushchim vremenem. ***A. A. Rudenko.*** *Pribory i Tekhnika Eksperimenta*, 1958, no. 6, Nov.-Dec., p. 60-62.

5553* Time Analyzer. Description of a 112-channel time analyzer with the minimal channel-width of 1 microsecond. The analyzer makes possible registration of several pulses during one cycle. (*In Russian.*) Vremennoĭ analizator. ***V. V. Okorokov.*** *Pribory i Tekhnika Eksperimenta*, 1958, no. 6, Nov.-Dec., p. 63-67.

5554* Recounting Apparatus With Decatrons. Description of a recounting apparatus with the resolution time of 12 microseconds and recounting factor of 10^5. The apparatus contains a device for automatic setting of the counting time (nine values from 3 to 25 minutes), an intensity meter, and a quartz calibrator. (*In Russian.*) Pereschetnyĭ pribor s ispol'zovaniem dekatronov. ***V. O. Viazemskiĭ, et al.*** *Pribory i Tekhnika Eksperimenta*, 1958, no. 6, Nov.-Dec., p. 76-81.

5555* A Circuit for Connecting Pulse Lamps With a High-Repetition Frequency of Flashes. Description of an economical circuit for connection of high-pressure pulse lamps with flash repetition frequencies up to 4000 cycles. The circuit provides long-time operation of lamps of an average power of about 5 kwt. (*In Russian.*) Skhema vkliucheniia impul'snykh lamp s bol'shoĭ chastotoĭ povtoreniia vspyshek. ***M. P. Vaniukov and V. I. Isaenko.*** *Pribory i Tekhnika Eksperimenta*, 1958, no. 6, Nov.-Dec., p. 85-88.

5556* Determination of the Cross Section of Adhesion of Slow Electrons to Molecules. Description of an apparatus which makes it possible to measure cross sections of the radiation and dissociation capture exceeding 10^{-2} cm^2. The width of the electron energy distribution is 0.2-0.3 ev.; the energy-scale accuracy is about 0.02 ev. (*In Russian.*) Opredelenie poperechnykh techeniĭ prilipaniĭ medlennykh elektronov k molekulam. ***N. S. Buchel'nikova.*** *Pribory i Tekhnika Eksperimenta*, 1958, no. 6, Nov.-Dec., p. 89-93.

5557* Investigation of Fast Ionization Processes in a Gas Stream Behind Shock Wave. Describes a method of measuring the coefficient of thermal ionization of gas in a stream behind shock wave propagating at about 3 km. per sec. The ionization process duration was about 200 microseconds. The measurements were made with a cavity resonator at the wavelength of 10 cm. The accuracy of the ionization factor measurements was about 10%. (*In Russian.*) Issledovanie bystrykh ionizatsionnykh protsessov v gazovom potoke za udarnoĭ volnoĭ. ***A. A. Brandt and R. Kh. Kurtmulaev.*** *Pribory i Tekhnika Eksperimenta*, 1958, no. 6, Nov.-Dec., p. 94-97.

5558* Measurement of Rapidly Changing Pressures in a Gaseous Medium. Describes the design and method of preparation of piezoelectrical sensing unit which makes it possible to determine the form of pressure pulses containing shock discontinuity (from 0.5 to 100 atm) during time varying from 60 to 200 microseconds. (*In Russian.*) Ob izmerenii bystromeniaiushchikhsia davleniĭ v gazovoĭ srede. ***S. G. Zaĭtsev.*** *Pribory i Tekhnika Eksperimenta*, 1958, no. 6, Nov.-Dec., p. 97-99.

5559* Registration of Pulse Light Fluxes With a Bolometer. Description of a device which makes possible direct registration of the light flux energy with a good time resolution. The maximum sensitivity is 0.2 cal/cm^2 sec. over the entire scale. Sensitivity over spectrum is uniform between 0.4 and 3 microns. (*In Russian.*) Registratsiia impul'snykh svetovykh potokov balometrom. ***Iu. A. Imas.*** *Pribory i Tekhnika Eksperimenta*, 1958, no. 6, Nov.-Dec., p. 100-101.

5560* Photoelectric Recorder of Double Refraction. Description of a photoelectric recorder of double refraction having Se photocells which makes it possible to measure the difference in the light intensity course with an accuracy up to ± 0.01 millimicron, without any amplification of the current. (*In Russian.*) Fotoelektricheskiĭ izmeritel' dvuprelomleniia. ***V. R. Regel' and G. A. Dubov.*** *Pribory i Tekhnika Eksperimenta*, 1958, no. 6, Nov.-Dec., p. 102-104.

5561* High-Efficiency Boric Counter. Description of a boric counter for structural investigations by the method of neutron diffraction. The counter is filled with enriched BF_3 (88% B^{10}) to the pressure of 700 mm. Hg. Calculations have shown the counter efficiency exceeds 90% for neutrons with energy of 0.07 ev. (*In Russian.*) Bornyĭ schetchik s vysokoĭ effektivnost'iu. ***V. N. Bykov and V. A. Levdik.*** *Pribory i Tekhnika Eksperimenta*, 1958, no. 6, Nov.-Dec., p. 113.

5562 Radioactivity Measuring Instruments. Measurements that can be made at slight cost with apparatus that can largely be made in any ordinary laboratory are described. The components required are now easily obtainable and very little power is necessary, so that many of the instruments can be made fully portable. Gives detailed instructions for making simple radioactivity measuring instruments, with some idea of the cost. ***M. C. Nokes.*** 75 pp. 1958. Philosophical Library, New York. (QC786 N69r)

5563* High-Resolution Electrostatic Lens-Analyzer of Electron Velocities. Describes single cylindrical electrostatic lens operating as an electron velocity analyzer with the resolution of 60,000 to 1. The dependence of the dispersion and resolution capacity of the analyzer upon its geometrical parameters is determined. (*In Russian.*) Elektrostaticheskaia linza-analizator skorosteĭ elektronov s vysokoĭ razreshaiushcheĭ sposobnost'iu. ***A. N. Kabanov and V. I. Miliutin.*** *Radiotekhnika i Elektronika*, v. 4, no. 1, Jan. 1959, p. 109-119.

See also: **5064** (chemical measuring instruments); **5319** (satellite instrumentation); **5741** (ingot temperature measurement).

LUBRICATION AND FRICTION

5564* Plane Sliders of Finite Width. Illustrates the manner by which the separation of variables in Reynold's equation may be effected, completes the solution of the resulting eigenvalue problem, and shows the formulation of the expressions for load capacity, frictional resistance, center of pressure, coefficient of friction, and rates of flow. Typical pressure hills are shown as well as approximate flow patterns throughout the slider area. ***Donald F. Hays.*** *ASLE Transactions*, v. 1, no. 2, Oct. 1958, p. 233-240.

5565* Determination of Optimum Proportions for Hydrostatic Bearings. Effect of recess size on the pressure, flow, and power requirements of several hydrostatic bearing configurations is described in terms of dimensionless coefficients called performance factors. Performance factors are determined analytically, compared graphically with the electric analog solutions for this bearing, and found to be in excellent agreement. For a given bearing configuration, there is a particular recess size which will give minimum supply pump power. ***A. M. Loeb and H. C. Rippel.*** *ASLE Transactions*, v. 1, no. 2, Oct. 1958, p. 241-247.

5566* The Viscosity Wedge. Equations are set up and solved numerically giving coefficients for oil film thickness and friction. Thickness is comparable (three quarters) of that carried by Michell pads. Computed results are applied to a parallel surface thrust bearing described by Fogg and shown to give tolerable agreement with experimental findings. ***A. Cameron.*** *ASLE Transactions*, v. 1, no. 2, Oct. 1958, p. 248-253.

5567* Parallel Surface Thrust Bearing. Theory for the thermal wedge thrust pad is given. Viscosity is allowed to vary in the direction of motion. Solutions are obtained by both analytical and relaxation methods for infinite and finite pads. Results are displayed non-dimensionally and graphically. ***A. Cameron and W. L. Wood.*** *ASLE Transactions*, v. 1, no. 2, Oct. 1958, p. 254-258.

5568* Lubrication of High-Speed High-Temperature Thrust Ball Bearings. Bearing rig tests in a once-through jet lubrication system with silicone fluid, mineral oil, and a synthetic ester lubricant resulted in friction failures at approximately 350, 650, and 800 F, respectively. With oil-air mist lubrication failure occurred at a much lower temperature. Demonstrates that deposits from lubricant decomposition did not play a significant role in the results and thus concludes that the small scale rig emphasized the deposit-free high temperature friction properties of lubricants. ***G. S. Reichenbach, J. B. Accinelli, and S. J. Beaubien.*** *ASLE Transactions*, v. 1, no. 2, Oct. 1958, p. 259-265.

5569* Effect of Lubricant Viscosity and Type on Ball Fatigue Life. Four paraffinic mineral oils with viscosities of 5 to 113 centistokes at the 100 F test temperature were used. Longer life was obtained with more viscous oil, life varying approximately as the 0.2 power of lubricant viscosity. In investigation of methyl silicone, a paraffinic mineral oil, a sebacate, a water base glycol, and an adipate were used. Each had a viscosity of about 10 centistokes at the 100 F test temperature. The 10% life was about 40 times as great with the silicone as with the adipate. ***William J. Anderson and Thomas L. Carter.*** *ASLE Transactions*, v. 1, no. 2, Oct. 1958, p. 266-272.

5570* Investigation of Oil Additives for Boundary Lubrication of Railroad Journal Bearings. Boundary friction properties of the lubricated system of steel sliding on lead-base babbitt were investigated on freight car hot boxes. A friction pendulum was developed for determining the coefficients of boundary friction as a function of temperature with the specified metals lubricated with various lube oil additive blends. Lubricity additives which chemisorb to metal surfaces and form a close-packed layer were found to be effective antifriction agents. ***Arnold Miller and Arthur A. Anderson.*** *ASLE Transactions*, v. 1, no. 2, Oct. 1958, p. 273-280.

5571* Influence of Temperature on Boundary Lubrication. Effects of temperature on the lubricity of a number of lubricants were studied. An apparatus designed to study lubricants under boundary conditions, with provisions for varying temperature, load, and speed, is described. Sharp transitions from smooth sliding to severe galling and seizure are observed at a specific temperature. "Failure temperatures" are useful in understanding the lubrication mechanism and in predicting lubricant performance. ***C. W. Cowley, C. J. Ultee, and C. W. West.*** *ASLE Transactions*, v. 1, no. 2, Oct. 1958, p. 281-286.

5572* Wear and Frictional Characteristics of Some Nickel-Base Alloys. Tests were made using a breakdown technique with a sliding velocity of 512 ft. per min. at the contact surfaces. Results showed that none of the wrought alloys tested were outstanding in their behavior when self-mated. Mating with dissimilar alloys containing hard phases or soft phases possessing lubricating qualities effected substantial improvements. Use of chromium, molybdenum disulfide, or sulfurized protective coatings was found feasible for inhibiting galling. ***R. A. Kozlik.*** *ASLE Transactions*, v. 1, no. 2, Oct. 1958, p. 296-303.

5573* Investigation of Wear by Electron Diffraction. Discusses monolayers, liquid lubricants, and greases, polished and amorphous films, the relation to wear of the crystallite size of surface phases, possible relations between wear and the orientation of surface films, solid lubricants, mechanism of extreme pressure lubrication, and the identification of wear debris. Molybdenum isobutylxanthate is an effetcive extreme pressure oil additive for hard steel. Cast iron top-piston-ring durability in a spark-ignition engine was studied using several fuels which gave widely different wear rates. ***L. M. Niebylski, M. Antler, and L. O. Brockway.*** *ASLE Transactions*, v. 1, no. 2, Oct. 1958, p. 304-311.

5574* A Study of the Effect of Wear Particles and Adhesive Wear at High Contact Pressures. Wear rate and friction characteristics were determined for certain combinations of cobalt base alloys and stainless steels when rubbed together at unit pressures up to 300,000 psi in an environment of demineralized water at room temperature. Wear rate and friction data were collected both in the presence and absence of wear particles. A study was also made on the effect of sliding-surface geometry in trapping wear particles. Results suggest that an exponential relationship exists between wear rate and stress for the materials of test. ***E. B. Sciulli and G. M. Robinson.*** *ASLE Transactions*, v. 1, no. 2, Oct. 1958, p. 312-318.

5575* Wear of Cobalt Base and Stainless Materials in High Purity Water. Results of wear tests in clean water at room temperature and at 500 F are presented. The differences in result with 0.08 in. diameter and line contact riders and with much larger riders are shown. Majority of the testing is at a linear velocity of about 2 in. per sec. Range and trend of friction values encountered in some of the tests is presented. ***N. B. Dewees.*** *ASLE Transactions*, v. 1, no. 2, Oct. 1958, p. 319-328.

5576* Cam and Tappet Lubrication. III. Radioactive Study of Phosphorus in the EP Film. Tightly bound films, which contain phosphorus and zinc, formed rapidly and then approached steady-state values in static and dynamic tests. The amount of film increased with oil temperature (200 to 300 F) and with available surface area. Dynamic test conditions greatly increased the amount of film formed, indicating the marked effect of surface temperature, pressure or wear. Chemical and physical properties of the films appeared to vary with the

conditions of film formation. ***E. H. Loeser, R. C. Wiquist, and S. B. Twiss.*** *ASLE Transactions*, v. 1, no. 2, Oct. 1958, p. 329-335.

5577 Pulse-Time Positioning Used for Safety Control of High Speed Tester. Describes the operation and fail-safe features of the safety devices for a high speed bearing and shaft seal testing machine, operating between 10,000 rpm and 110,000 rpm. ***Merle E. Fitch.*** *IRE Transactions on Industrial Electronics, PGIE-8*, Jan. 1959, p. 25-30. (TK1 In6.6ie Vis.)

5578* Effective Lubrication for Power Presses. Application, Selection and Handling. ***Bruce Dunham.*** *Machine and Tool Blue Book*, v. 54, Feb. 1959, p. 118-125.

5579* Future Lubricating Grease Requirements in the Steel and Underground Coal Mining Industries. One lubricant will predominate in future, suitable for use in gear cases and miscellaneous bearings of all types of equipment, semi-fluid in nature with a sufficiently light consistency to feed to gears and splash lubricated bearings in gear cases, and yet with consistency heavy enough to stay in bearings. ***J. C. Van Gundy.*** *NLGI Spokesman*, v. 22, no. 11, Feb. 1959, p. 499-504.

5580* Milling of Greases. I. The Mechanisms of Dispersion. II. Some Practical Benefits of Mechanical Dispersion. Phases of manufacture and how they affect appearance and performance of lubricating grease. Thermal and mechanical dispersions of soap particles in lubricating grease. Proper dispersion results in improved appearance, increase in yield, improved shear stability, uniformity of product, improved storage stability, decreased leakage tendencies, improved pumpability, and improved antibleed characteristics. Utilization of inorganic thickening agents. I. ***K. H. Birkett.*** II. ***J. J. Dickason.*** *NLGI Spokesman*, v. 22, no. 11, Feb. 1959, p. 505-512.

5581 Lubricating a 5,000 h.p. Gas Turbine. Basic lubricating oil supply system consists of direct-driven 196 gal/min. positive displacement main pump, a 140 gal/min. positive displacement auxiliary pump, and 80 gal/min. centrifugal emergency pump. Main pump has sufficient capacity to supply all lubricating and control oil requirements under gas turbine idling conditions. Auxiliary pump delivery capacity is sufficient for starting unit, and permits continuous plant operation in event of breakdown of main pump. Emergency pump can supply sufficient lubrication during plant shut-down and will ensure adequate heat dissipation from the bearings during cool down. *Scientific Lubrication*, v. 11, Jan. 1959, p. 19-21.

5582 A Research Program on the Investigation of Seal Materials for High Temperature Application. The finest wear performance was attained when Kentanium K162B ran against Kentanium K162B at sliding speeds of 14,000 fpm in an ambient temperature of 1100 F. ***Raymond H. Baskey.*** *U. S. Air Force, Wright Air Development Center, WADC Technical Report* 58-181, June 1958, 64 pp. (TL507 Un3.18w Vis.)

5583 Current Status of Knowledge on Design Criteria for Bearings Used in High Temperature Aircraft Electrical Accessories. Fluids under consideration are silicones, silicate esters, silanes, mineral oils, polyphenyls and polyphenyl ethers, fluorinated organic compounds, esters, and polyolefins. In the bearing design, loose clearances, open curvatures, and land riding cages seem most desirable. M-50 tool steel bearings containing "S" Monel or Ni Resist Cages show successful performance. Two systems that appear most promising are grease-packed bearings and a modified "once through" system. ***P. Lewis, S. F. Murray, and A. A. Schwartz.*** *U. S. Air Force, Wright Air Development Center, WADC Technical Report* 58-519, Sept. 1958, 50 pp. (TL507 Un3.18w Vis.)

5584* Surface Damage Caused by Polyvinyl Chloride Sliding on Steel. Survey of the different types of debris and surface damage encountered during friction experiments; formation of rolls which lie at right angles to the direction of motion; temperature below which rolls do not form; temperature above which rolls form very freely and frequently the coefficient of friction falls; formation of other types of debris. ***D. I. James.*** *Wear*, v. 2, no. 3, Feb. 1959, p. 183-194.

5585* On the Hydrodynamic Lubrication of Roller-Bearings. Analysis of the lubrication of cylindrical roller-bearings; expressions derived for the maximum film pressure, load capacity of the bearing, frictional moment on the shaft, and coefficient of friction; limits of the theory investigated. ***J. F. Osterle.*** *Wear*, v. 2, no. 3, Feb. 1959, p. 195-202.

5586* An Investigation of Piston-Cylinder and Shaft-Bearing Friction at Low Temperatures. Initial shearing force and friction on repeated movement of a piston were measured in a unit of special design between −60 and +20 C. Results for 10 different oils are explained in terms of thixotropy and viscosity of the oils. Friction of a bearing between −40 C and +10 C was measured for the same lubricants. ***M. P. Volarovich.*** *Wear*, v. 2, no. 3, Feb. 1959, p. 203-216.

5587* The Interactions of Wear Debris With Fatty Additives in Lubrication. Steel surfaces lubricated with mineral oil solution in reciprocating sliding. The coefficient of friction and the electrical contact resistance were measured simultaneously. Influence of smooth and damaged surfaces and of various surrounding atmospheres are compared. Smooth surface and the oxygen-poor atmosphere most favorable for the lubricants. ***Yasukatsu Tamai.*** *Wear*, v. 2, no. 3, Feb. 1959, p. 228-236.

See also: **5974** (surface friction).

MECHANICAL ENGINEERING

5588 Analytical Design of an Ackermann Steering Linkage. A method is outlined whereby the dimensions of an Ackermann steering linkage may be determined analytically. The theoretical relation between the angles of rotation of the front wheels of a vehicle is derived and it is shown how this relation may be approximated by a symmetrical four-bar linkage. ***W. A. Wolfe.*** *ASME, Transactions, Series B, Journal of Engineering for Industry*, v. 81, no. 1, Feb. 1959, p. 10-14.

5589 Structural Error Analysis in Plane Kinematic Synthesis. Methods are developed for estimating and obtaining minimum structural error in the approximate synthesis of plane, function, or path-generating mechanisms. The application to a four-bar function generation mechanism is worked out with the aid of a large-scale digital computer used in the manner of a servo loop. ***Ferdinand Freudenstein.*** *ASME, Transactions, Series B, Journal of Engineering for Industry*, v. 81, no. 1, Feb. 1959, p. 15-22.

5590 The Design of Linkages to Generate Functions of Two Variables. Graphical methods are presented for designing linkages that have two inputs and one output. Two basic approaches are developed. The desired function is matched at a limited number of positions with the maximum number being seven. Designs are also developed which match the derivatives of the desired function at a single point. The designs were developed with ease of solution and broadness of application as primary considerations. ***C. W. Allen.*** *ASME, Transactions, Series B, Journal of Engineering for Industry*, v. 81, no. 1, Feb. 1959, p. 23-29.

5591 Helical Springs of Hollow Circular Cross Section. A theoretical and experimental investigation of elastic shear stresses and deflection in an axially loaded helical spring having a hollow circular section is reported. Two analyses are presented: An approximation of the stresses by strength-of-materials theory and a more accurate elasticity-theory solution for stresses and deflection. The results are compared with strain and deflection measurements on an actual tubular spring. ***C. W. Bert.*** *ASME, Transactions, Series B, Journal of Engineering for Industry*, v. 81, no. 1, Feb. 1959, p. 30-36.

5592 Design of Helical Springs for Minimum Weight, Volume, and Length. Equations and graphs are presented for the selection of a spring index that will result in a spring of minimum weight, volume, or length. If, in addition to these requirements, the inside or outside diameter of the spring is fixed, there is only one solution. Equations and graphs are included for the selection of the spring index which will satisfy this additional requirement. ***R. T. Hinkle and I. E. Morse, Jr.*** *ASME, Transactions, Series B, Journal of Engineering for Industry*, v. 81, no. 1, Feb. 1959, p. 37-42.

5593* Hydrodynamical Investigation on the Submerged Hydrofoil. III. Theoretical explanation for the wave resistance recovery, regarding the wave from the forward foil as the stationary wave. The theoretical expression for the lift, wave resistance, and moment is carried to the second order, and numerical calculations are made. ***Tetsuo Nishiyama.*** *American Society of Naval Engineers, Journal,* v. 71, no. 1, Feb. 1959, p. 135-144.

5594* Creating a Transfer Machine. Development of a multistation machine to automatically perform successive machining operations on a workpiece. Engineering functions which must be performed are discussed, and illustrated by examples. ***Robert Brehm.*** *Automation,* v. 6, Feb. 1959, p. 42-51.

5595* Vibratory Agitating and Processing. Description and operation of vibratory equipment. Uses in installations where feeding, conveying, agitating, and other functions are combined. ***Lester R. Moskowitz.*** *Automation,* v. 6, Feb. 1959, p. 61-64.

5596 Torsional Vibrational Experiments on Rectangular Concrete Beams. Measurements of the dynamic shear modulus of specimens of concrete by a torsional resonance technique. The modulus is not significantly influenced by the frequency at which it is measured. ***R. Jones.*** *British Journal of Applied Physics,* v. 10, Jan. 1959, p. 51-52.

5597* The Characteristic Method of Solution for the Problem of Plane Plastic Strain. Solution to equations represented by series of characteristic curves which allow the determination of the stress and velocity conditions at all points in the deforming zone. Application of the method used in the study of the direct extrusion process. Theoretical solution for process compared with results obtained experimentally. ***J. Halling.*** *Engineer,* v. 207, Feb. 13, 1959, p. 250-254.

5598 A Creep Analysis of Rotating Solid Disks. Based on the maximum shear theory, an analysis of creep deformations and stress distributions in rotating solid disks operating at elevated temperature is presented. At steady-state condition, creep rate is assumed to be the product of a function of stress, a function of time, and a function of temperature. ***B. M. Ma.*** *Franklin Institute, Journal,* v. 267, no. 2, Feb. 1959, p. 149-165.

5599 Developments in Methods of Measuring Stresses in Compressor and Turbine Blades on Test Bed and in Flight. ***D. A. Drew.*** *Institution of Mechanical Engineers, Proceedings,* v. 172, no. 8, 1958, p. 320-359.

5600 Thermal Stresses in Design. IX. Elastic-Stress Solutions. Two approximate methods for simplified analysis of complex relationships in thermoelastic equations. ***S. S. Manson.*** *Machine Design,* v. 31, Mar. 5, 1959, p. 125-130.

5601 Hydraulic Switching Circuits. I. "And", "Or", and "Not" Logic Functions: Efficient Design Tools for Synthesizing Complex Hydraulic Circuits. Function combinations; theorems; switching equations; circuit problems; flow truisms; typical equation proof; "not" function equations; component selection. ***Harold R. Ronan, Jr.*** *Machine Design,* v. 31, Feb. 19, 1959, p. 140-145.

5602 Designing and Using Noncircular Gears to Generate Mathematical Functions. Advantages and limitations; design alternatives; application considerations; gear design. ***Frederick W. Cunningham.*** *Machine Design,* v. 31, Feb. 19, 1959, p. 161-164.

5603 Helical-Spring Design. Charts and equations for a simplified "short-cut" approach; permissible wire stress; working-stress relationships; design examples; lateral buckling; design calculations. ***J. Hirschhorn.*** *Machine Design,* v. 31, Feb. 19, 1959, p. 165-169.

5604 Why and Where to Use Carbide-Base Cermets. Each of the three major families of carbide-base cermets—tungsten, chromium and titanium carbide—offers a different combination of properties. The most recent improvement in WC-Co cermets has been the increase in impact strength gained by addition of more cobalt. Previously, the practical limit of cobalt content has been about 25% by weight; sagging and distortion during sintering occurred when larger amounts were added. Recent process developments now permit the addition of up to 35% cobalt. ***William W. Wellborn.*** *Materials in Design Engineering,* v. 49, Feb. 1959, p. 79-81.

5605 Field and Laboratory Examples of Industrial Noise Control. Techniques for reduction of noise in existing equipment. Examples of modifications to eliminate noise problems. ***A. L. Cudworth.*** *Noise Control,* v. 5, Jan. 1959, p. 39 + 5 pages.

5606* Designing Pumps and Blowers for Nuclear Power Plants. Design limitations of pumps and machines with high sealing standards and radioactivity protection; includes radial and axial compressors. ***R. A. Strub.*** *Nuclear Power,* v. 3, Dec. 1958, p. 592-594.

5607 Proceedings of the Society for Experimental Stress Analysis. ***C. V. Mahlmann and W. M. Murray, editors.*** v. XVI. 198 pp. 1958. Society for Experimental Stress Analysis, Cambridge, Mass. (TG265 So13p Vis.)

5608* Combating the Noise in Industrial Plants by the Confinement of the Noise Spectrum. Fundamental acoustic notions: level of sound intensity; sound frequency; and noise spectrum. Measuring and evaluating a noise by means of its spectrum. Lines for evaluating the noise nuisance of machines. Noise spectra of various machines and their evaluation. (*In German.*) Bekämpfung des Betriebslärms unter Berücksichtigung des Geräuschspektrums. ***Reinhard Köhler.*** *Stahl und Eisen,* v. 79, no. 1, Jan. 8, 1959, p. 37-41.

5609* Overload Clutch Designed for Accurate Torque Control. Requirements, characteristics, and final design of clutches for power transmission. ***Bernard R. Better.*** *Tool Engineer,* v. 42, no. 3, Mar. 1959, p. 87-89.

5610* On the Computation of Strain of Noncircular Pipes Under External Pressure. I. The Buckled, Originally-Cylindrical Pipe. A solution for determining the changes in shape and the stress condition, provided the material stress occurs in the flexible range. An approximation method for the computation of a pipe having an original elliptical cross section. (*In German.*) Zur Spannungsberechnung unrunder Rohre unter Aussendruck. I. Das ausgebeulte ursprünglich kreiszylindrische Rohr. ***Kurt Schmidt.*** *VDI Zeitschrift,* v. 101, no. 2, Jan. 11, 1959, p. 47-54.

5611* Vibration Phenomena on Turbo-Generators With Steel Foundations. II. Study of vibrations showed that their resonance ranges and amplitudes are mainly governed by the very variable damping characteristics of the system during the starting and slow running period. Theoretical observation of the machine foundation coupled with the shafting system permitted generalization of the existing theories for turbines. The coupling of the system causes the resonance points to be split up into two resonance peaks. A remedy can be provided by selecting the highest possible damping properties. (*In German.*) Schwingungserscheinungen an Turbogeneratoren mit Stahlfundamenten. II. ***Karl Schäff and Karl-Heinz Krieb.*** *VDI Zeitschrift,* v. 101, no. 2, Jan. 11, 1959, p. 55-62.

5612* Single-Stage High-Pressure Centrifugal Pumps. Advantages of pumps of this type include simple construction, insensitivity to impurities in the liquid handled, and ease in sealing a split casing. The high speeds employed have led to reduced floor space requirements and to low material costs. (*In German.*) Einstufige Hochdruckschleuderpumpen. ***Richard Roosen.*** *VDI Zeitschrift,* v. 101, no. 2, Jan. 11, 1959, p. 63-67.

5613* Eliminating Rotation Errors From Pump Head Measurements. Method of determining effects of swirl at static-pressure tappings has given satisfactory results in MERL closed circuit for pump testing. ***R. A. Nixon.*** *Water and Water Engineering,* v. 63, Jan. 1959, p. 9-11.

See also: **5994** (pump troubles).

METALLURGY

5614* A Thermodynamic Study of the Titanium-Sulfur System in the Region $TiS_{1.93}$ to $TiS_{0.80}$. Equilibrium H_2S/H_2 ratios were determined as functions of temperature and composition in a hydrogen recirculation apparatus. ***R. P. Abendroth and A. W. Schlechten.*** *American Institute of Mining, Metallurgical, and Petroleum Engineers, Transactions, Metallurgical Society,* v. 215, no. 1, Feb. 1959, p. 145-151.

5615* Studies of Slugs From Explosives With Lined Cavities. I. Metallographic studies of a copper slug propelled by a high explosive charge having a metal lines conical cavity. ***S. Singh, A. Soundraraj, and R. C. Deshpande.*** *American Institute of Mining, Metallurgical, and Petroleum Engineers, Transactions, Metallurgical Society,* v. 215, no. 1, Feb. 1959, p. 166-168.

5616 Metals Foamed at GE. General Electric finds a way to make light, rigid foams of nickel, copper, and cast iron. *Chemical and Engineering News,* v. 37, no. 6, Feb. 9, 1959, p. 56.

5617 Applying New Alloy Steel for Lower Strip Maintenance. Versatile new high-strength alloy replaces castings for greater strength and longer life, and permits major increases in bucket size because of light weight. Abrasion resistance prolongs life in many preparation applications. ***Andrew Hyslop and D. S. Kleckner.*** *Coal Age,* v. 64, Feb. 1959, p. 126-128.

5618 Higher Temperature Metals and New Forming Methods Mark 1958 as Year of Progress in Metals. Melting metals in jets of heat ranging up to 30,000 F, steels with strengths exceeding 400,000 lb. per sq. inch, perfection of techniques for the forming of metal parts by controlled explosions and the rolling of metal strip directly from metal powders are among the outstanding metals engineering developments of 1958. ***Clarence H. Lorig.*** *Industrial Heating,* v. 26, Jan. 1959, p. 46 + 4 pages.

5619 Can Fe-Cr-Al Alloys Ever Replace Stainless? *P. M. Unterweiser.* *Iron Age,* v. 183, no. 6, Feb. 5, 1959, p. 90-92.

5620 Need Low-Cobalt Stainless for Nuclear Applications. With the rise of nuclear applications in industry, more attention will have to be paid to trace cobalt contents in commercial steels—especially stainless. The ideal stainless steel for atomic energy applications would have no cobalt at all. Even the slightest trace impurities of this element would be strained from the end product. Unfortunately, some cobalt shows up as an impurity in virtually all commercial stainless. It poses a serious problem in atomic energy applications because it creates radioactive isotopes in both the fissionable fuel and in non-fissionable matter exposed to irradiation. Most elements have radioactive isotopes or nuclides created by neutron capture. Some newly formed nuclides have a short half life with weak irradiations. Others can last for many years emitting strong γ radiations. Cobalt belongs to this latter group. ***W. L. Fleischmann.*** *Iron Age,* v. 183, no. 7, Feb. 12, 1959, p. 106-107.

5621 New Primary Magnesium Plant Under Construction. Application of magnesium and magnesium alloys, and some property tables for magnesium alloys and titanium alloys. *Magazine of Magnesium,* 1959, Feb., p. 1.

5622 Metal Parts for Operating at Higher and Higher Temperatures. Experts in the field of powder metallurgy gathered at Reutte, Austria, in June to discuss "High-Melting Metals, Their Manufacture, Properties and Applications". Columbium, molybdenum, tungsten, tantalum, appear to hold most promise. ***D. A. Robins.*** *Metal Progress,* v. 75, no. 1, Jan. 1959, p. 84-86.

5623 The Metal Thorium. *Harley A. Wilhelm, editor.* 397 pp. 1958. American Society for Metals, Cleveland. (TN799.T4 M56)

5624 Maunsel White. An Early Worker on High Speed Steels. There is still a certain amount of controversy about the origin of high speed steel. In this article, the author refers to the work of Maunsel White in this field, carried out in collaboration with F. W. Taylor, but makes no attempt to discuss the rival claims. ***Eric N. Simons.*** *Metallurgia,* v. 59, Jan. 1959, p. 10-12.

5625 Automatic Manufacture of Bearings. Timken Roller Bearings' Bucyrus Plant. Costs had to be lowered, speed of production increased, and the quality of the product improved. Quality had to be systematically standardized, so that each bearing part produced would be of equal quality and precision. The excellent results of this careful planning were revealed when details of the plant were made public. Thirty-three million cups and twenty-seven million cones can be produced each year. *Metallurgia,* v. 59, Jan. 1959, p. 13-16.

5626* Zirconium and Its Alloys. Principal producing countries; workable reserves and working prospects. Zirconium metallurgy; alloying with Al, Ta, and Be. (*In French.*) Le zirconium et ses alliages. *Métallurgie et la Construction Mécanique,* v. 91, Jan. 1959, p. 29 + 4 pages.

5627 Steels for Aircraft. There are five basic metallurgical requirements that must be met if this country is to build the world's fastest and best airplanes: First, and perhaps the most important, is strength. A minimum tensile strength of 200,000 psi or higher will be necessary to meet design requirements, and the metal must maintain this strength throughout the range of temperatures encountered in flight. Second, the metal must have corrosion resisting properties. (Certain conditions may make this requirement less significant.) The third requirement is producibility. Fourth is availability in large tonnages and from numerous sources. The final requirement is fabricability into finished assemblies, by equipment and skilled workmen in many plants. ***R. B. Gunia.*** Paper from "Metals for Supersonic Aircraft and Missiles", p. 411-414, 1958. American Society for Metals, Cleveland. (TL699.M4 M56)

5628 The Light Metals—Aluminum, Magnesium, Titanium. All metals lose strength rapidly as the melting point is approached, and the metal ceases to have properties of interest, from an engineering standpoint, some hundreds of degrees below the melting point. In spite of the high melting point of titanium, the alloys thus far developed do not have high-strength properties at extreme temperatures. The field of usefulness of the light metals is therefore in the moderate temperature range. ***R. R. Kennedy.*** Paper from "Metals for Supersonic Aircraft and Missiles", p. 202-216, 1958. American Society for Metals, Cleveland. (TL699.M4 M56)

5629 The Properties of Eleven Less Common Metals. The need for metals with properties that are valuable in aerodynamic applications leads to consideration of elements not customarily used for structural purposes. Eleven of these metals have been selected for examination as to properties that might be of interest to designers of aerodynamic equipment. The eleven elements are: chromium, columbium, hafnium, iridium, molybdenum, osmium, rhenium, tantalum, tungsten, vanadium, and zirconium. ***B. A. Rogers.*** Paper from "Metals for Supersonic Aircraft and Missiles", p. 261-314, 1958. American Society for Metals, Cleveland. (TL699.M4 M56)

5630 Titanium Alloys. Perhaps the greatest immediate need is for much higher strength (approaching 200,000 psi when tested at room temperature) for use in aircraft forging and sheet applications at 600 to 800 F. This is a large jump in strength from the alloys currently being used having strengths of 110,000 to 120,000 psi. Any such strength level dictates heat treatment, and this in turn requires alpha-beta or beta alloys. ***Robert I. Jaffee.*** Paper from "Metals for Supersonic Aircraft and Missiles", p. 406-411, 1958. American Society for Metals, Cleveland. (TL699.M4 M56)

5631 Tool and Die Steels. There has been a great deal of interest during the past year in applying the product of the toolsteel industry to aircraft and guided missiles for both room-temperature and elevated-temperature service. Actually, this results from a new concept in ferrous metallurgy. The basic concept to be applied in this instance is the use of materials that have a combination of very important metallurgical properties; essentially they are (a) air hardening, (b) deep hardening, (c) have secondary hardening characteristics, (d) have low internal stresses after hardening and tempering to high strength levels, (e) permit high tempering temperatures and therefore (f) have a stable structure at any given operating

temperature up to 1000 F, and (g) possess these properties through martensitic hardening and tempering and not through cold work or standard precipitation as ordinarily defined. Metals of this sort, properly balanced in alloy composition to be nonstrategic and of the minimum cost to provide secondary hardening characteristics, will actually produce structural parts of higher properties and higher life expectancy than can be obtained with any of the lower alloy materials which have commonly been applied for these purposes to date, whether we are considering service at room or at somewhat elevated temperatures. ***George A. Roberts.*** Paper from "Metals for Supersonic Aircraft and Missiles", p. 414-419, 1958. American Society for Metals, Cleveland. (TL699.M4 M56)

5632 Superalloys for Airframe Structures. Any application of superalloys to the airframe structure must be justified on a strength-to-weight basis, and for temperatures up to 1200 F (which is much lower than their intended environment in jet engines) they should only be compared with the other metals and alloys which might serve within the top 100 degrees of the range in question, namely 1100 to 1200 F. ***Sidney Badger.*** Paper from "Metals for Supersonic Aircraft and Missiles", p. 419-423, 1958. American Society for Metals, Cleveland. (TL699.M4 M56)

5633* Rare Metals. A healthy interest remains in the "new" metals which offer great promise because of their unique physical characteristics. ***M. H. Kline.*** *Mining Congress Journal*, v. 45, Feb. 1959, p. 114-115.

5634* Foamed Aluminum. Density can range from 12 to 70 pounds per cubic foot. Magnesium-aluminum alloys reportedly foam the best. ***Jack R. Kreigh.*** *Modern Castings*, v. 35, Feb. 1959, p. 37.

5635* Liquid Metals. Article presents in a convenient form the properties and individual characteristics of the liquid metals suitable for reactor coolants. ***J. W. Evans.*** *Nuclear Engineering*, v. 4, Feb. 1959, p. 59-63.

5636* The "New" Engineering Materials—Titanium, Zirconium, Tantalum, Niobium, Beryllium, Molybdenum. Applications of the above in the more progressive industries—aircraft manufacture, the chemical industry, electronics, nuclear power production, the building of high-speed launches. *Overseas Engineer*, v. 32, Feb. 1959, p. 226-229.

5637 Refractory Metals and Their Alloys. A literature search. ***Theodore F. Davis.*** *U. S. Atomic Energy Commission, TID*-3524, Jan. 1959, 10 pp. (UF767 Un3ti Contin.)

5638 Vacuum Metallurgy. Encompasses virtually the entire field—production and measurement of vacuum; vacuum melting techniques (including the new electron bombardment); degassing of metals; and the metallurgical applications of vacuum processing to powdered and electronic materials, coatings, and high temperature alloys. Much new material resulting from basic research as well as that based on practical engineering data is included. There is also a treatment of the specific applications of the concepts of thermodynamics and kinetics to vacuum metallurgy and a discussion of future trends. ***Rointan F. Bunshah, editor.*** 472 pp. 1958. Reinhold, New York. (TN686 B88v)

See also: **4899** (metals for supersonic aircraft and missiles); **4903** (AISI and stainless steels for aircraft applications); **5368** (distribution of iron and steel firms); **5376** (iron and steel industry in Europe).

METALS—CORROSION

5639* Fretting of Hardened Steel in Oil. Tests of AISI 4340 steel were made in an oil bath using a new machine designed to make fretting corrosion tests with a wide range of parameters. Hardness values from 258 to 743 Vickers were tested, the hardest specimen having a nitrided surface. Galled areas were measured for depth of pit and height of deposit with the results indicating some small effects due to hardness up to 460 Vickers. The nitrided specimens produced smaller fretted areas and the roughening of their surfaces was shallow. ***J. R. McDowell.*** *ASLE Transactions*, v. 1, no. 2, Oct. 1958, p. 287-295.

5640* Oxidation of Three Iron-Nickel Alloys and Iron at 800°C. A high-temperature X-ray diffraction method has been used to study the composition and the kinetics of formation of oxide scales at 800 C on iron and pure iron-nickel alloys containing 25.6, 75, and 84% Ni. ***S. W. Kennedy, L. D. Calvert, and M. Cohen.*** *American Institute of Mining, Metallurgical, and Petroleum Engineers, Transactions, Metallurgical Society*, v. 215, no. 1, Feb. 1959, p. 64-72.

5641 Stress Corrosion of Austenitic Stainless Steels in Low-Pressure Steam and in Hot Water. Stresses in steel sheets; effect of type of water; time required for stress corrosion cracking to start; effect of oxygen. Effect of salts dissolved in water. Note on experiments aimed at elimination of stress corrosion in water and steam. ***S. Brennert and H. Nathorst.*** *Henry Brutcher Translation No.* 3831, 16 pp. 1958. (From *Jernkontorets Annaler*, v. 140, no. 11, 1956, p. 839-853.) Henry Brutcher, Altadena, Calif.

5642 Effect of Cathodic and Anodic Polarization on the Rate of Stress Corrosion of Austenitic Stainless Steel. Plotting of cathodic and anodic polarization curves for stress corrosion of 0.01% C, 20 Cr, 10 Ni, 0.06 Ti steel in boiling 42% magnesium chloride, and micrographic study of effect of polarization on nature of corrosion cracks. ***V. V. Romanov and V. V. Dobrolyubov.*** *Henry Brutcher Translation No.* 4277, 8 pp. (From *Metallovedenie i Obrabotka Metallov*, no. 7, July 1958, p. 19-21.) Henry Brutcher, Altadena, Calif.

5643 Effect of Grain Size on the Resistance of Steels to Cavitation Erosion. Relationships in single-phase (austenitic, ferritic) steels. Mechanism of cavitational destruction. Cavitation erosion in steels with duplex structures as function of grain size, component making up the network proper, and brittleness or toughness of steel; mechanism of cavitational failure. ***I. N. Bogachev and R. I. Mints.*** *Henry Brutcher Translation No.* 4317, 6 pp. (From *Metallovedenie i Obrabotka Metallov*, no. 8, Aug., 1958, p. 26-29.) Henry Brutcher, Altadena, Calif.

5644* Internal Cathodic Protection. Introduction and general principles. ***C. Plumpton and C. Wilson.*** *Corrosion Prevention & Control*, v. 6, Jan. 1959, p. 31-36.

5645* German Standardization Practice With Accelerated Corrosion Tests. I. Details are given of results obtained with a co-operative test program which had the object of obtaining unification and reproducibility of test results and to approach the short-term accelerated test results as far as possible to the results obtainable under long-term, practical service conditions. ***B. M. Pearson.*** *Corrosion Prevention & Control*, v. 6, Jan. 1959, p. 50 + 2 pages.

5646* Erosion Wear and Wear Protection of Austenitic Steels for Gas Turbine Blades. The best method of protection from erosive wear is by simultaneous saturation by C, Cr, and N, or the two latter elements, when the coefficient of resistance to erosion is increased by 10 or more. The character and mechanism of erosive wear on blades is described. (*In Russian.*) Erozionnyĭ iznos i zashchita ot iznosa austenitnykh staleĭ dlia lopatok gazovykh turbin. ***V. I. Prosvirin and A. I. Fedosov.*** *Inzhenerno-Fizicheskiĭ Zhurnal*, v. 2, no. 1, Jan. 1959, p. 6-14.

5647 New Tubing Fights Corrosion. "Composite tubing" features dissimilar metals which are metallurgically bonded into an inseparable jacket-and-liner relationship. ***J. B. Ulam.*** *Iron Age*, v. 183, no. 8, Feb. 19, 1959, p. 123-125.

5648 Nitric Acid Corrosion of Austenitic Stainless Steels. A recent paper by Heeley and Little is examined in the light of some experiments of the corrosion resistance of some Ti-stabilized 18 Cr-8 Ni steels in hot 30% nitric acid. ***J. M. West.*** *Journal of Applied Chemistry*, v. 9, pt. 1, Jan. 1959, p. 1-10.

5649* Mechanism of Stress-Corrosion Cracking in the AZ31B Magnesium Alloy. The mechanism of stress-corrosion cracking of annealed AZ31B magnesium alloy in an aqueous $NaClK_2CrO_4$ solution was investigated. ***Hugh L. Logan.*** *Jour-*

nal of Research, National Bureau of Standards, v. 61, no. 6, Dec. 1958, p. 503-508.

5650 Corrosion in Cooking Utensils. Deposits of more noble metals over less noble metals are to be avoided unless the deposits have no pores. Carbon particles from burnt-on foodstuffs can give rise to galvanic currents. A dense pore-free structure in the material used will control corrosive attack. ***H. Kessler.*** (Reprinted from *Aluminium*, Feb. 1957.) *Light Metals*, v. 22, Jan. 1959, p. 14-16.

5651* Licking the Problem of Stress-Corrosion Cracking. High-pressure steam, either pure or containing acid or salt vapors, quickly causes intergranular cracks in aluminum bronze pressure vessels. Trouble is permanently avoided by addition of a fractional percent of tin. ***John F. Klement, Robert E. Maersch, and Patrick A. Tully.*** *Metal Progress*, v. 75, no. 2, Feb. 1959, p. 82-86.

5652 Kinetics of Oxidation in a Gas Stream. There are several characteristics of this type of chemical reaction which serve to define what is meant by the oxidation of a metal. One of these characteristics is that the reaction is heterogeneous and does not proceed exclusively in the interior of one phase. Heterogeneous reactions occur between two immiscible phases and frequently result in the formation of a new phase. In the present case, reaction occurs between the oxidants in the gas phase and a solid-phase metal or alloy with the production of an oxide phase. ***J. T. Waber.*** Paper from "Metals for Supersonic Aircraft and Missiles", p. 96-169, 1959. American Society for Metals, Cleveland. (TL699.M4 M56)

5653 Thicker Decorative Chromium for Better Corrosion Resistance. Concludes that the corrosion resistance of Ni-Cr (or Cu-Ni-Cr) deposits on either steel or zinc-base die castings can be substantially improved by increasing the thickness of the final Cr plate (both cracked and crack-free) considerably above the 0.01 and 0.02 mil heretofore regarded as standard. ***E. J. Seyb and W. H. Rowan.*** *Plating*, v. 46, Feb. 1959, p. 144-149.

5654 Demonstration of the Theory of Cathodic Protection. Theory and mechanism of cathodic protection and its practical adaptability to pipelines in the Appalachian area. ***William J. Kretschmer, Herbert F. Byrns, and Jack Brown.*** *West Virginia University, Technical Bulletin No.* 52, Oct. 1958, p. 15-21. (TA21 W52t Contin.)

5655 An Engineering Approach to the Selection of Pipe Line Coating. ***J. A. Schauers.*** *West Virginia University, Technical Bulletin No.* 52, Oct. 1958, p. 50-56. (TA21 W52t Contin.)

5656 Corrosion Control Incorporated Into Pipe Line Design and Construction. Factors of electrical insulation and cathodic protection of a buried structure under protection from any other metal structure not under the same protective system. ***William R. Curley.*** *West Virginia University, Technical Bulletin No.* 52, Oct. 1958, p. 57-62. (TA21 W52t Contin.)

5657 Application of Cathodic Protection. Protection of oil and gas transmission lines. ***D. A. Tefankjian.*** *West Virginia University, Technical Bulletin No.* 52, Oct. 1958, p. 63-71. (TA21 W52t Contin.)

5658 Intermediate Analysis of Stray Current Corrosion. The analysis of stray DC currents in the ground, their effects on buried structures, and the measures taken to relieve the buried structures from their harmful effects. ***Ted Watson.*** *West Virginia University, Technical Bulletin No.* 52, Oct. 1958, p. 72-90. (TA21 W52t Contin.)

5659 Fundamentals of the Corrosion Process as Applied to Lead Sheath Cables. ***Ernest W. Seay, Jr.*** *West Virginia University, Technical Bulletin No.* 52, Oct. 1958, p. 196-201. (TA21 W52t Contin.)

5660 Inherent Resistance of Cast Iron Pipe to Corrosion. ***Thomas F. Wolfe.*** *West Virginia University, Technical Bulletin No.* 52, Oct. 1958, p. 257-260. (TA21 W52t Contin.)

5661 Corrosion and Its Control in Water Systems. ***R. G. Dalbke and H. Kerst.*** *West Virginia University, Technical Bulletin No.* 52, Oct. 1958, p. 261-279. (TA21 W52t Contin.)

5662 Cathodic Protection of Well Casing. ***Y. W. Titterington.*** *West Virginia University, Technical Bulletin No.* 52, Oct. 1958, p. 311-321. (TA21 W52t Contin.)

METALS—EXTRACTION AND REFINING

5663* Heat Flow and Temperature Distribution Around a Copper Converter Tuyere. Relaxation calculations were made to find the temperature distribution in the refractory wall surrounding a tuyère pipe. ***W. A. Krivsky and R. Schuhmann, Jr.*** *American Institute of Mining, Metallurgical, and Petroleum Engineers, Transactions, Metallurgical Society*, v. 215, no. 1, Feb. 1959, p. 82-86.

5664* An Investigation of Gas Flow in a Small Blast Furnace. Rates and patterns of gas flow were investigated by measurements, at three levels, of gas compositions and temperatures and by direct determination of gas transit time by a new method employing mercury vapor as a tracer. ***H. W. Hosking, W. O. Philbrook, and N. B. Melcher.*** *American Institute of Mining, Metallurgical, and Petroleum Engineers, Transactions, Metallurgical Society*, v. 215, no. 1, Feb. 1959, p. 96-103.

5665* A Mercury-Vapor Method for the Study of Gas Movement in the Blast Furnace. A simple and inexpensive mercury-tracer method to study rates and patterns of gas flow in blast furnaces. ***H. W. Hosking, W. O. Philbrook, and N. B. Melcher.*** *American Institute of Mining, Metallurgical, and Petroleum Engineers, Transactions, Metallurgical Society*, v. 215, no. 1, Feb. 1959, p. 104-110.

5666 Studies of Formation of Nonmetallic Inclusions in the Deoxidation [of Steel] With Silicon. Microchemical and metallographic studies. Electrochemical isolation of unsaturated and saturated silicate inclusions. Conversion of wustite to magnetite to facilitate isolation of inclusions and results obtained thereby. ***W. A. Fischer and M. Wahlster.*** *Henry Brutcher Translation No.* 4416, 16 pp. (From *Archiv f. d. Eisenhüttenwesen*, v. 29, no. 1, 1958, p. 1-9.) Henry Brutcher, Altadena, Calif.

5667 Degassing of Aluminum Alloys by Ultrasonic Vibrations. Degassing of a molten aluminum alloy containing 2% Cu, 0.8% Mg, 2.5% Si, 1.0% Ni, 1.0% Fe, 0.1% Ti, rest Al. Description of setup with special reference to materials for, and design of, the waveguide. Method of determining the degree of degassing. ***M. B. Al'tman, D. V. Vinogradova, V. I. Slotin, and G. I. Eskin.*** *Henry Brutcher Translation No.* 4417, 9 pp. (From *Izvestiya Akad. Nauk SSSR, Otd. Tekh. Nauk*, no. 9, Sept. 1958, p. 25-30.) Henry Brutcher, Altadena, Calif.

5668 Electrolytic Preparation of Titanium From Fused Salts. II. Design of Laboratory Cells. ***Marshall B. Alpert, James A. Hamilton, Frank J. Schultz, and William F. Sullivan.*** *Electrochemical Society, Journal*, v. 106, Feb. 1959, p. 142-144.

5669 Process for Electrolytic Extraction of Titanium Metal From Titanium Carbide Anodes. Purity of the metal is adequate for many uses including powder metallurgy and for feed material to an electrorefining process making maximum purity metal. ***Guy Ervin, Jr., Herbert F. G. Ueltz, and Malcolm E. Washburn.*** *Electrochemical Society, Journal*, v. 106, Feb. 1959, p. 144-146.

5670 Hot-Blast Cupola Operation . . . Two Case Histories. *Foundry*, v. 87, Mar. 1959, p. 156.

5671 Basic Brick in Copper Converters—Their Mineralogical Changes. Confirms experience showing that burned chrome-magnesite and burned magnesite brick give excellent service in copper converters. ***C. Burton Clark and J. Spotts McDowell.*** *Journal of Metals*, v. 11, Feb. 1959, p. 119-124.

5672 Fluidized Beds for Metal Production. Metal production by vapor deposition in a fluidized bed has been the result of applying the chemistry of vapor plating to the engineering involved in handling fluidized solids. Commercial possibilities

depend on availability of low-cost feeds. ***J. H. Oxley and I. E. Campbell.*** *Journal of Metals*, v. 11, Feb. 1959, p. 135-137.

5673 Preparation of Iodide Thorium. Describes the van Arkel-de Boer process which has proved to be a satisfactory method of producing high-purity thorium for experimental purposes. The relatively low as-deposited strength of iodide thorium places a limitation on the size of the crystal bars that can be produced. ***N. D. Veigel, E. M. Sherwood, and I. E. Campbell.*** Paper from "The Metal Thorium", p. 104-113, 1958. American Society for Metals, Cleveland. (TN799.T4 M56)

5674* Recovery of Tantalum by Electrolysis. (*In Russian.*) Elektroliticheskiĭ sposob polucheniia tantala. ***Iu. I. Ostroushko, G. A. Meerson, G. F. Silina, and R. B. Shtrapenina.*** *Tsvetnye Metally*, v. 31, no. 12, Dec. 1958, p. 38-44.

5675* Preparation and Purification of Selenium From the Anode Mud of the Electrolytic Copper Refining Process. The new process described yields twice as much selenium as the usual method. A wet-mill purification allows the elimination of arsenic from raw selenium, so that the material can be used for the processing industry. Highly purified selenium (99.995%) was obtained also by a subsequent high purification process by normal pressure distillation. This paper offers a description of the classical extraction of selenium, a theoretical basis to the new process, details on tests and current production (roasting of anode mud, alkali leaching, neutralization of the alkali leaching solution, precipitation of selenium with SO_2-gas, economy of the process) and an account of the results obtained in using the purified selenium in manufacturing rectifiers. (*In German.*) Herstellung und Reinigung von Selen aus dem Anodenschlamm der elektrolytischen Kupferraffination. ***S. Löschau.*** *Zeitschrift für Erzbergbau und Metallhüttenwesen*, v. 12, Jan. 1959, p. 21-27.

See also: **5005** (surface tension and contact angles of liquid metal-ceramic systems).

METALS—FINISHING, POLISHING, AND CLEANING

5676 Metal Finishing Guidebook Directory. A comprehensive summary of progress in finishing technique including sections on surface preparation, plating solutions and procedures, and organic finishing. 27th Ed. 762 pp. 1959. Metals and Plastics Publications, Inc., Westwood, N. J. (T13 M56f)

5677 Metal Powders for Barrel Finishing. Finishing media and typical finishes obtained. ***G. C. Madigan.*** *Metal Powder Association, Proceedings*, v. 14, 1958, p. 71-78. (TN695 M56p Vis.)

5678 Pickling Procedures and Adjustments for Various Soils. Metal preparation for porcelain enameling. ***Harold C. Wilson.*** *Metal Products Manufacturing*, v. 16, Mar. 1959, p. 46-47.

5679* The Preparation of Metals for Protective Finishes. Specific metals discussed: iron and steel, aluminum, copper, magnesium, stainless steel, tin, and zinc. ***R. E. Shaw.*** *Metallurgical Reviews*, v. 3, no. 12, 1958, p. 327-356 + 4 plates.

METALS—FOUNDRY PRACTICE

5680 Preliminary Blowing of Hot Metal in Ladles With a Steam-Oxygen Mixture. Composition variation of different types of hot metal (basic and high P) held in ladles and blown with oxygen plus 0 to 40 weight-% of steam. Blowing variables: volume and pressure of O, steam/oxygen ratio, depth of immersion of O lance; conditions insuring a minimum of brown fumes. Hot metal temperature during blow; metal losses and H content of metal before and after blowing. ***Ya. A. Shneerov, A. G. Derfel', A. G. Kotin, M. T. Bul'skii, and A. G. Alimov.*** *Henry Brutcher Translation No.* 4424, 11 pp. 1958. (From *Metallurg*, no. 8, Aug. 1958, p. 11-14.) Henry Brutcher, Altadena, Calif.

5681 Test Bar and Casting Properties. Describes differences between properties of separately cast test bars and those of production castings. ***W. J. Reichenecker.*** *Foundry*, v. 87, Mar. 1959, p. 64-68.

5682 The Carbon Dioxide Process. Investigations indicate that quartz sand is not the ideal molding material for the CO_2 process in production of heavy-walled castings. Carbon dioxide is used most economically when heated before gassing. ***Waldemar Schumacher.*** *Foundry*, v. 87, Mar. 1959, p. 69-75.

5683 New Vacuum Stream-Degasser Yields Quality Steels. Vacuum stream-degassing capacity is enlarged by a new modern installation. This setup eliminates the pony ladle and boosts efficiency. *Iron Age*, v. 183, no. 6, Feb. 5, 1959, p. 88-89.

5684 How to Make Shell Molding Pay. Shell molding offers opportunities to simplify both casting design and processing. Usually advantages outweigh the added cost of resin binder. *Iron Age*, v. 183, no. 6, Feb. 5, 1959, p. 96-98.

5685 Electron-Bombardment Melting. A furnace that works like an immense X-ray tube may bring about a major breakthrough in the refractory metals. Its effect on columbium is dramatic. The furnace purifies the metal so highly that a 3-in. bar can be rolled into foil 0.0005-in. thick without annealing. ***Hugh R. Smith, Charles d'A. Hunt, and Charles W. Hanks.*** *Journal of Metals*, v. 11, Feb. 1959, p. 112-117.

5686 Steelmaking Progress in Belgium and Luxemburg. Such interesting results were obtained with the experimental low-shaft blast furnace that a large furnace has been operating economically on fine coke with 15% moisture. Excellent steel and agricultural slag result. ***A. Decker.*** *Metal Progress*, v. 75, no. 1, Jan. 1959, p. 65-70.

5687* Vacuum Metallurgy in Europe. Their potential is beginning to interest fabricators who need better and more dependable alloys. ***A. M. Aksoy.*** *Metal Progress*, v. 75, no. 2, Feb. 1959, p. 87-89.

5688* The Pouring Time of Sand Castings. To calculate for each casting the appropriate pouring time means, that a very important foundary variable has been eliminated. The pouring time has to fulfill: a. a condition of heat loss by the metal; b. a condition of heat load on the molding material; c. the condition resulting from the danger of erosions. The condition b. gives an upper and c. a lower time limit. It is always necessary to make a special study of the cores. Making use of the mathematical solution of the heat transfer between mold and metal published during the International Foundry Congress, Firenze 1954, Paper 54, a simple equation has been deduced containing two limiting conditions: a. a condition of superheat; b. a condition of heat loss during the filling of the mold. Some applications complete the paper. (*In Dutch.*) Gietijden voor in zand gegoten gietwerk. ***J. S. Abcouwer.*** *Metalen*, v. 14, no. 1, Jan. 15, 1959, p. 2-6.

5689* Tempering Molding Sand. Test procedures for actual and compensated moisture tests are described. A method of determining the riddled density of sand is given, and its relationship to moisture percentage shown. The use of high-strength sands is on the increase. ***H. W. Dietert, V. Rowell, and A. L. Graham.*** *Modern Castings*, v. 35, Feb. 1959, p. 55-61.

5690 Modern Foundry Practice. For this edition the text has been thoroughly revised and enlarged wherein new material deals with the use of spheroidal-graphite cast iron, pressure-cast aluminum pattern plates, epoxy resin patterns, pop-off flasks and resin-bonded cores. Shell molding and the carbon dioxide process are also described. ***E. D. Howard, editor.*** 3rd Ed. 464 pp. 1959. Philosophical Library, New York. (TS230 H83m3)

5691 Die Casting Under Reduced Atmospheric Pressure. Different methods of producing die castings with the die cavity partially evacuated were discussed. *Precision Metal Molding*, v. 17, Feb. 1959, p. 30-31.

5692 Ultra High-Purity Metals Produced by Electron Beam Melting. *Precision Metal Molding*, v. 17, Feb. 1959, p. 32.

METALS—HEAT TREATMENT

5693 Improved Heat-Treating Processes for Large Forgings. ***N. V. Fiksen.*** *Henry Brutcher Translation No.* 4095, 7 pp. (From *Metallovedenie i Obrabotka Metallov*, no. 11, Nov. 1957, p. 77-80.) Henry Brutcher, Altadena, Calif.

5694* Measurement of Cooling Efficiency During Water Quenching. (*In Czech.*) Měření ochlazovací účinnosti při kalení do vody. ***Vladimir Kraus.*** *Hutnické Listy*, v. 14, no. 1, Jan. 1959, p. 9-17.

5695 Electronic Device Simulates Furnace Heating Problems. Thanks to Thermalog–a new temperature analog simulator–many complex heating (and cooling) problems can now be solved accurately and in a relatively short time. Heat treating and forging problems are particularly suited to Thermolog analysis. But the simulator can just as readily tackle heat transfer problems that apply to nonmetallic materials, gases, or liquids. Returning to our original examples, the new simulator can be used to accurately plot heat transfer from the outer surface of a forging billet to its center thus assuring proper forging temperature throughout the billet. Or it can predict time and heat input needed to achieve complete temperature uniformity in a steel part prior to quenching. A special electronic device, Thermolog, was developed by Selas Corp. of America, Dresher, Pa. It isn't for sale—but its services in problem solving are available on a contract basis. Included with the use of the simulator are the services of a trained engineering staff familiar with its operation. ***P. M. Unterweiser.*** *Iron Age*, v. 183, no. 7, Feb. 12, 1959, p. 102-104.

5696 Compact Furnace Anneals Strip. Describes a furnace with controlled atmosphere capable of temperature to 2100 F for annealing stainless steel strip. ***D. L. Somers and C. A. Turner.*** *Iron Age*, v. 183, no. 9, Feb. 26, 1959, p. 94-95.

5697* Austempering and Martempering Practices. Furnace builders have managed to translate experimental findings into production equipment which will give consistent results in heat treated parts. Both oil and salt quenching are practical. ***A. F. Holden.*** *Metal Progress*, v. 75, no. 2, Feb. 1959, p. 74-75.

5698* Thermal Treatment in Salt Baths. Advantages, composition and effect of nonactivated and activated carbonizing baths, hardening bath and its possibilities. Applications and data concerning the safe use of salt baths. (*In Dutch.*) Warmtebehandeling in zoutbaden. ***H. Koops.*** *Metalen*, v. 13, no. 24, Dec. 31, 1958, p. 436-440.

5699 Proceedings From the International Symposium on the Annealing of Low Carbon Steel Held at Case Institute of Technology in Cleveland, Ohio on Oct. 29 and Oct. 30, 1957. Because of its inherent low cost and high formability, low carbon sheet steel finds extensive use in all parts of the world. It is the most commonly used metal of our modern economy. A vital unit operation in the production of this material is the annealing step since the mechanical behavior of the sheet is greatly dependent upon this operation. Papers on the Effect of Hot Working and Cleaning Factors on the Final Characteristics of Annealed Cold Rolled Steel; Quench Aging, Strain Aging, Yield and Flow Phenomena in Low Carbon Steel; Orientation and Anisotropy in Low Carbon Steel Sheets; the Recirculation of Steel-Melting Furnace as a New Unit for Producing Low Carbon Steel; Present-Day Annealing and How It Is Affected by Cold Work; Annealing Cycles for Commercial and Drawing Quality Rimmed Steels; Generation and Use of Prepared Atmospheres in the Annealing of Low Carbon Steel Strip; Short Time Annealing of Cold Worked Low Carbon Steel; Effect of Variation in Annealing Cycle and Composition on Mechanical Properties of Continuously Annealed Tin Plate; The Economics of Annealing in the United States; Annealing of Cold Reduced Sheets and Coil in Europe; Performance Criteria; Summary of the Symposium; Selected References. 138 pp. Case Institute of Technology and the Lee Wilson Engineering Co., Inc., Cleveland. (TS360 In8p Over.)

5700* A Roller Hearth Furnace for Continuous and Batch Annealing of Stainless Steel Tubes. Consists of a loading table, a furnace with pneumatically operated doors at charge and discharge ends, a quench unit and unloading table. The several sections are equipped with transverse rollers forming a continuous roller hearth throughout the entire length of the equipment. ***E. A. Hasnip and M. P. Shaw.*** *Process Control and Automation*, v. 6, Jan. 1959, p. 8-14.

5701 The Heat-Treatment of Electroless Nickel Coatings. The response to heat-treatment of chemically deposited Ni-P coatings has been investigated over a temperature range of 250 to 750 C. Data are presented for coatings covering a range of 7 to 10% P. ***K. T. Ziehlke, W. S. Dritt, and C. H. Mahoney.*** *U. S. Atomic Energy Commission*, K-1308, Feb. 2, 1959, 20 pp. (UF767 Un3.1k Contin.)

METALS—MECHANICAL AND PHYSICAL PROPERTIES

5702* Measurement of Cobalt and Nickel Vapor Pressures. (*In Russian.*) Izmerenie davleniia parov kobal'ta i nikelia. ***An. N. Nesmeyianov and De Dyk Man.*** *Akademiia Nauk SSSR, Doklady*, v. 123, no. 6, Dec. 21, 1958, p. 1064-1067.

5703* The Effects of Solid-Solution Alloying on the Creep-Rupture Strength of Alpha and Beta Titanium. Iodide-grade titanium, two oxygen alloys, and two aluminum alloys were studied by means of creep-rupture tests from 1000 to 2000 F. An evaluation was made of, (1) the relative creep-rupture strengths of the α and β forms of titanium and some of its alloys; (2) the effects of solid-solution strengthening by oxygen and aluminum on the α and β structures; and (3) the extent and effect of atmospheric oxygen alloying on rupture life in tests above 1000 F. ***L. S. Richardson and N. J. Grant.*** *American Institute of Mining, Metallurgical, and Petroleum Engineers, Transactions, Metallurgical Society*, v. 215, no. 1, Feb. 1959, p. 18-23.

5704* A Comparison of the Creep-Rupture Properties of Nickel in Air and in Vacuum. At low stresses the properties are better in air, while at high stresses they are better in vacuum. A mechanism, involving two competing processes in terms of oxidation strengthening and weakening by surface-energy reduction, is proposed to explain these reversals. ***P. Shahinian and M. R. Achter.*** *American Institute of Mining, Metallurgical, and Petroleum Engineers, Transactions, Metallurgical Society*, v. 215, no. 1, Feb. 1959, p. 37-41.

5705* On the Deformation Characteristics of Certain Dilute Copper-Base Solid-Solution Alloys. Evidence is presented that copper-base solid solutions of different solutes having equal grain sizes, no preferred crystallographic orientation, equal electron-atom ratios, and, within experimental scatter, identical initial yield strengths, need not have identical stress-strain curves at strains larger than about 0.04. ***N. G. Ainslie, R. W. Guard, and W. R. Hibbard, Jr.*** *American Institute of Mining, Metallurgical, and Petroleum Engineers, Transactions, Metallurgical Society*, v. 215, no. 1, Feb. 1959, p. 42-48.

5706* Deformation Resulting From Grain Boundary Sliding. The determination of equations relating elongation to the amount of shear taking place both along grain boundaries and in slip planes of polycrystalline aggregates during creep. ***H. Brunner and N. J. Grant.*** *American Institute of Mining, Metallurgical, and Petroleum Engineers, Transactions, Metallurgical Society*, v. 215, no. 1, Feb. 1959, p. 48-56.

5707* Effect of Changes in Slip Direction on the Creep of Magnesium Crystals. The strain hardening associated with the creep of magnesium single crystals at room temperature was investigated by shear tests in which the direction of stressing was reversed a number of times after creep in a $<100>$ direction. ***H. Conrad.*** *American Institute of Mining, Metallurgical, and Petroleum Engineers, Transactions, Metallurgical Society*, v. 215, no. 1, Feb. 1959, p. 58-63.

5708* The Magnetostrictive Contribution to Endurance Life. The effect of a near-saturation unidirectional magnetic field was to decrease slightly the endurance life in Armco iron in the annealed condition. ***K. Winterton.*** *American Institute of Mining, Metallurgical, and Petroleum Engineers, Transactions, Metallurgical Society*, v. 215, no. 1, Feb. 1959, p. 72-74.

5709* An Experimental Determination of the Electrical Resistivity of the Liquid Alloys Hg-In, Hg-Tl, Ga-In, Ga-Sn, and of Liquid Gallium. Measurements were made near room temperature by a potentiometric method using pure Hg as a reference material. ***L. G. Schulz and P. Spiegler.*** *American Institute of Mining, Metallurgical, and Petroleum Engineers, Transactions, Metallurgical Society*, v. 215, no. 1, Feb. 1959, p. 87-90.

5710* The Effect of High-Temperature Strain on Crack Formation and Ductility in Commercially Pure Nickel. The effect of a prior high-temperature creep strain on the low-temperature ductility of commercially pure nickel has been evaluated. ***D. Kramer and E. S. Machlin.*** *American Institute of Mining, Metallurgical, and Petroleum Engineers, Transactions, Metallurgical Society*, v. 215, no. 1, Feb. 1959, p. 110-112.

5711* Pressure Required for Transformation Twinning in Explosively Loaded Low-Carbon Steel. ***D. R. Curran, S. Katz, J. J. Kelly, and M. E. Nicholson.*** *American Institute of Mining, Metallurgical, and Petroleum Engineers, Transactions, Metallurgical Society*, v. 215, no. 1, Feb. 1959, p. 151-153.

5712* Ductility in Beryllium Related to Grain Orientation and Grain Size. ***J. Greenspan.*** *American Institute of Mining, Metallurgical, and Petroleum Engineers, Transactions, Metallurgical Society*, v. 215, no. 1, Feb. 1959, p. 153-163.

5713* The Heat Capacity of Dilute Solutions of Chromium in Nickel. Heat contents of four Cr-Ni alloys were determined in a diphenyl ether calorimeter. ***R. Hultgren and C. Land.*** *American Institute of Mining, Metallurgical, and Petroleum Engineers, Transactions, Metallurgical Society*, v. 215, no. 1, Feb. 1959, p. 165-166.

5714 Temporary Changes in Mechanical Properties [of Steel] During Phase Transformations. Literature data on uncommonly high plasticity of zinc alloys, copper alloys, and various machinery and tool steels while undergoing phase transformations. Experiments aimed at amplifying Bochvar's theory on 'superplasticity'. Evaluation of results and their usefulness in the development of new (distortion-free) heat treating practices. ***V. G. Vorob'ev.*** *Henry Brutcher Translation No.* 4175, 8 pp. (From *Metallovedenie i Obrabotka Metallov*, no. 3, Mar. 1958, p. 35-38.) Henry Brutcher, Altadena, Calif.

5715* Measuring Strain at Extreme Temperatures. Measurement of material strains at stabilized and transient temperatures can be accomplished by resistance strain gages over the range from −320 F to 450 F. Environmental test chambers were set up for both low and high temperatures. ***Donald J. Madsen.*** *Electronic Equipment Engineering*, v. 7, Feb. 1959, p. 59-61.

5716 Reducing Scuffing and Wear of Ferrous Metals. Surface Treatment by Sulfinuz Process. This process is to impregnate steel or cast iron surfaces with S and N, to reduce scuffing and wear. Surfaces are treated in a molten salt bath of cyanide and S compounds at about 570 C from 5 minutes to 3 hours. After two hours at 570 C, a "white" microscopic surface layer about 0.0005 in. in depth can be observed. Nitrogen penetrates beyond this white layer and confers some benefit to the metal below. ***F. D. Waterfall.*** *Engineering*, v. 187, Jan. 23, 1959, p. 116-120.

5717* Contribution to the Study of Spheroidal Cast Iron and Mild Steel Deformation. The deformation progress at static and impact compressive tests on specimens of mild steel and ferritic annealed spheroidal cast iron was studied. (*In Czech.*) Příspěvek ke studiu deformace tvárné litiny a měkké oceli. ***Aleš Vetiška.*** *Hutnické Listy*, v. 14, no. 1, Jan. 1959, p. 30-38.

5718* Properties of Austenitic Nickel-Chrome Steels Deformed at Low Temperatures. (*In Czech.*) Vlastnosti chromniklových austenitických ocelí tvářených za nízkých teplot. ***Josef Vodsed'álek and Miloslav Šicho.*** *Hutnické Listy*, v. 14, no. 1, Jan. 1959, p. 38-43.

5719* Pertaining to the Secondary Hardness of High Speed Steel. (*In Czech.*) O sekundární tvrdosti rychlořezné oceli. ***Jaroslav Ježek and Josef Vobořil.*** *Hutnické Listy*, v. 14, no. 1, Jan. 1959, p. 47-54.

5720 Improve Fatigue Strength With Abrasive Tumbling. Sponsored by the Abrasive Grain Association, the test program proves the usefulness of tumbling in attaining better fatigue strength. *Iron Age*, v. 183, no. 8, Feb. 19, 1959, p. 129-131.

5721 Internal Friction of Copper and Copper Alloys. Reports and discusses some measurements of the nonlinear (i.e., amplitude dependent) damping attributed to dislocations. The measurements were made on single crystals of copper with controlled impurity content vibrating at about 37 kc in the fundamental longitudinal mode. A systematic experimental study has been made of the effect of adding small amounts of gold to copper on the dislocation damping in copper measured at 37 kc in longitudinal resonance. The results have been classified in terms of the dependence of the damping on strain amplitude and time with temperature and composition as parameters. ***Daniel N. Beshers.*** *Journal of Applied Physics*, v. 30, Feb. 1959, p. 252-258.

5722 Strength of Gold Whiskers. The mechanical behavior of whiskers such as copper, silver, and zinc is characterized by (1) high elastic strengths (sometimes in excess of 0.01E, where E is the Young's modulus), (2) very sharp yield points, and (3) plastic flow with the propagation of Lüders bands at a flow stress as small as 1% of the yield stress. Fourteen gold whiskers were strained in tension in the apparatus described elsewhere. The gold whiskers were grown on quartz by C. R. Morelock of this laboratory by condensing supersaturated gold vapor in air at about 1040 C. Most of the whiskers tested were less than 1 mm in length with some as short as 300μ. X-ray diffraction from one of the whiskers showed that its axis was parallel to the [110] direction. The cross-sectional areas of the whiskers were estimated to range from 2 to 14 x 10^{-8} cm^2. ***S. S. Brenner.*** *Journal of Applied Physics*, v. 30, Feb. 1959, p. 266-267.

5723 Notch Sensitivity and Directionality in Fatigue in Light Alloy Extrusions as Shown by Endurance and Progressive Loading Tests. This paper deals with further experimental studies of the progressive loading fatigue test described in an earlier paper by the same author (*Metallurgia*, v. 54, 1956, p. 151-158). It suggests that the test could, with considerable saving of time, replace conventional endurance testing in the assessment of such factors as notch sensitivity, changes in design and suitability of materials used in components and structures. ***J. McKeown.*** *Metallurgia*, v. 59, Jan. 1959, p. 31-38.

5724* Nickel Steels for Service at Low Temperatures. Introduction and historical notes on past research work on steel characteristics at low temperatures. Reasons of present interest in materials for service at low temperatures. General effects of low temperatures on the mechanical characteristics of steels. Effect of individual alloying elements. Influence of various types of heat treatment. Wrought steels (3.5 and 9% nickel steels in particular) and cast nickel steels, observations on production and working, notes on heat treatments and obtainable mechanical characteristics. Notes on the austenitic cast steels and on the influence of chemical composition. (*In Italian.*) Acciai al nichel per applicazioni a basse temperature. ***E. T. Gill.*** *Metallurgia Italiana*, v. 50, Dec. 1958, p. 522-528.

5725* Study of Models in the Elastoplastic Field. A test on a steel model of a portal frame, stressed to give elastoplastic strains, is described. The strain distribution has been determined by means of electric resistance strain-gages and sheets of photoelastic material bonded to the surface of the model, the photoelastic examination being performed by reflection. The experimental results are compared with those obtained by a calculus analysis. (*In Italian.*) Studio su modello nel campo elastoplastico. ***G. Moravia.*** *Metallurgia Italiana*, v. 50, Dec. 1958, p. 541-548.

5726* Research on the Mechanical Properties of Metals at Liquid-Helium Temperatures. ***H. M. Rosenberg.*** *Metallurgical Reviews*, v. 3, no. 12, 1958, p. 357-379 + 1 plate.

5727 Nickel and Cobalt Base Alloys. Over the last decade, nickel and cobalt-base alloys have found a large number of applications in heat engines. Ability to resist severe service environments and heat conditions has been proved and has developed an increasing usage for certain specialty alloys. Experience has shown that the intrinsic characteristics imparted

by the elements nickel and cobalt have contributed materially to the progress and advancement on many engineering frontiers. ***F. S. Badger and G. A. Fritzlen.*** Paper from "Metals for Supersonic Aircraft and Missiles", p. 234-260, 1958. American Society for Metals, Cleveland. (TL699.M4 M56)

5728* Metals Under High Speed Loading. Bodies react to high speed loading in exceedingly complex and, usually, difficult-to-describe ways, and manifest behavior patterns that are vastly different from conventional behavior patterns. ***John S. Rinehart.*** *Mines Magazine*, v. 49, Feb. 1959, p. 19 + 7 pages.

5729 Internal Stresses and Fatigue in Metals. A symposium on Internal Stresses and Fatigue in Metals was held Sept. 3-5, 1958, at the General Motors Research Laboratories. Invited papers were presented by research workers in solid-state physics, metal physics, and engineering from England, France, Germany, and the United States. The singular feature of the conference is the attempt to clarify some of the basic aspects of the two phenomena by considering them in the light of concepts of solid-state physics or physical metallurgy rather than in empirical engineering terms alone, and thus to promote a deeper understanding of the interaction of the phenomena by the "interaction" of their metal physics and engineering aspects. It is surprising to note how rapidly, through this interaction, the extensive progress in metal physics has transformed the engineer's approach to the properties of the materials he uses, and has provided him with the beginning of that "sense of structure" which Cyril Smith considers to be the characteristic mark of the modern approach to the mechanics of materials, as distinct from the conventional or "classical" approach based on the mechanics of the solid isotropic continuum. ***A. M. Freudenthal.*** *Physics Today*, v. 12, Feb. 1959, p. 16-19.

5730* State of the Art: Beryllium. Ductility problems have been exaggerated; weldability and formability better than expected; reinforced Be skins foreseen for structural use. ***Irwin Stambler.*** *Space/Aeronautics*, v. 31, no. 2, Feb. 1959, p. 48-51.

5731 Effect of Prior Creep on Mechanical Properties of Aircraft Structural Metals. III. C110M Titanium Alloy. ***Jeremy V. Gluck. Howard R. Voorhees, and James W. Freeman.*** *U. S. Air Force, Wright Air Development Center, WADC Technical Report* 57-150, May 1958, 88 pp. (TL507 Un3.18w Vis.)

5732 Multiaxial Creep Studies on Inconel at 1500 F. Creep rate and rupture life of axially loaded pressurized Inconel tubes were studied at 1500 F for the purpose of developing failure criteria based on properties measured in the conventional uniaxial tension test. ***C. R. Kennedy, W. O. Harms, and D. A. Douglas.*** *U. S. Atomic Energy Commission, ORNL*-2622, Feb. 5, 1959, 38 pp. (UF767 U3o Contin.)

See also: **4902** (properties of metals for aircraft and missiles); **5022** (abrasion testing); **5747** (tensile testing of irradiated uranium); **5770** (effect of microstructure on strength); **5771** (structural changes in Ni-Cr-Fe alloy during creep rupture testing); **5823** (properties of U, Pu, and Th metals); **5933** (magnetization direction in Ni).

METALS—MECHANICAL WORKING

5733* Workpiece Compatibility of Ceramic Cutting Tools. The performance of ceramic and cemented carbide tools is compared when machining a wide variety of metals. ***M. C. Shaw and P. A. Smith.*** *ASLE Transactions*, v. 1, no. 2, Oct. 1958, p. 336-344.

5734 Stress and Strain in Spinning Paraboloid Dishes. An investigation to determine completely the state of stress and strain in spinning paraboloid dishes both whole and holed at the center. The material of the dish is homogeneous and its thickness is constant. The results comprise expressions for the radial, hoop, and shear stresses, the bending moments, and deformation induced by the spinning of the dish in terms of the angular distance from the center of the dish. ***M. J. Cohen.*** *ASME, Transactions, Series B, Journal of Engineering for Industry*, v. 81, no. 1, Feb. 1959, p. 43-50.

5735 Bending Aluminium. Choice of materials; bending properties. Procedures and equipment for bending sheet and strip, plate, bars, and tubes. *Aluminium Development Association, Information Bulletin* 24, Nov. 1958, 47 pp. (TS550 AL82i Vis.)

5736* Coolants for Chucking Automatics. Development of Soluble Oils Suitable for High Speed Operation With Sintered Carbide Tools. *Automobile Engineer*, v. 49, Feb. 1959, p. 72-73.

5737* The Fairey-Ferranti 3-D Miller. Describes research and development work culminating in design and manufacture of 50-ton, 20 hp automatic milling machine for light alloys. ***R. Coleman, J. Gregson, and A. Flett.*** *Discovery*, v. 21, Feb. 1959, p. 66-73.

5738* The Measurement of Speeds on Machine Tools by Means of Electronic Methods. A theoretical and experimental analysis of five speed measuring methods led to the development of electronic measuring devices covering a wide range of speeds. For the lowest range, an inductive instrument with a carrier frequency system was used. For higher speeds a new capacitive measuring method was developed, used with an inductive-dynamic system with extremely good frequency response. (*In German.*) Das Messen von Geschwindigkeiten an Werkzeugmaschinen mit Hilfe elektrischer Verfahren. ***Günther Budnick.*** *Forschung auf dem Gebiete des Ingenieurwesens* (Ausgabe B), v. 24, *VDI-Forschungsheft* 470, 1958, 52 pp.

5739 New Method Speeds Machining of Honeycomb Core Material. Interrupted arcing, at the rate of 2500 impulses per second, is the basis of this way to machine. *Iron Age*, v. 183, no. 6, Feb. 5, 1959, p. 94-95.

5740 Cold Extrusion Shows One Way to Diversify With Profit. There are many parts now made by other methods that can probably be cold extruded cheaper, faster, and better. These range from cup-shaped pieces like universal joint bearings, to long, thin cylindrical sections and shafts. ***R. H. Eshelman.*** *Iron Age*, v. 183, no. 7, Feb. 12, 1959, p. 95-97.

5741 Ingot Surface-Temperature Measurement in Forging Furnaces. A number of surface pyrometers using the disappearing filament technique were tested. One instrument incorporating a reflecting hemisphere head, to correct for emissivity errors in surface temperature measurement, was found to be suitable for the temperature range of 800-1,300 C. Scale on the surface examined does not interfere with the operation of this pyrometer. ***J. R. Pattison.*** *Iron and Steel Institute, Journal*, v. 191, pt. 2, Feb. 1959, p. 163-171.

5742 Remote Position Control of Screwdown Drives of Primary Rolling Mills. ***L. N. Bramley, F. Seredynski, L. J. Chant, and G. K. Steel.*** *Iron and Steel Institute, Journal*, v. 191, pt. 2, Feb. 1959, p. 176-185.

5743 The Application of Remote Position Control to Forges. ***L. J. Chant and F. Seredynski.*** *Iron and Steel Institute, Journal*, v. 191, pt. 2, Feb. 1959, p. 185-191.

5744 When to Specify Microhoning. Advantages; applications of microhoning; surface characteristics. ***Don S. Connor.*** *Machine Design*, v. 31, Feb. 19, 1959, p. 153-155.

5745 The Production of Ball and Roller Bearings. Methods and equipment employed. Special equipment includes an automatic flaw detector capable of checking balls in 1 sec. each, oscilloscope apparatus for roundness testing, vibration analysis equipment, automatic machine tool control equipment, and precision electronic gages. *Machinery (London)*, v. 94, Jan. 21, 1959, p. 120-131.

5746 Turning Alloy Steels With Ceramic and Carbide Tools. Ceramic tips by a variety of makers were tested, and carbide tips by two makers (one British and the other American) were tested for comparison purposes. *Machinery (London)*, v. 94, Feb. 11, 1959, p. 325 + 11 pages.

5747* **Machining Irradiated Uranium.** A Myford center lathe was bolted in an inverted position to a channel frame, preventing irradiated swarf from falling into lathe bed and crevices. The set up was housed in a Windscale shielded fume-hood. Tensile testing of machined specimens was carried out on a Honnsfield Tensometer modified for remote handling behind lead enclosure. ***D. Shaw and W. G. Hufton.*** *Nuclear Power*, v. 3, Dec. 1958, p. 600-601.

5748* **Residual Stresses Resulting From the Forming of High Strength Aluminium Alloys.** An X-ray back reflection technique used to measure the surface residual stresses resulting from cold and hot forming. Residual stresses are affected by the heat treatment (cold or hot quench) and the amount (if any) of controlled stretching that the alloy has had between solution treatment and precipitation. ***G. A. Hawkes.*** *Royal Aeronautical Society, Journal*, v. 63, Feb. 1959, p. 90-94.

5749* **Powder Torch Cutting in Manufacture of Chemical Apparatus.** In the case of a stabilized as well as of an unstabilized Cr-Ni steel 18/8 it was found that, when a kinetically active powder was used, the thermally affected zone exhibits a welding structure. There was no carbide precipitation in the non-stabilized material. (*In German.*) Der Pulverbrennschnitt im chemischen Apparatebau. ***Valentin Trunschitz.*** *Schweisstechnik*, v. 12, Nov. 1958, p. 148-152.

5750 Lubrication of New Metals During Heat Treatment and Forming. Use of low-melting glass as extrusion lubricant for Ti alloys. ***J. Grindrod.*** *Scientific Lubrication*, v. 11, Jan. 1959, p. 13-14.

5751* **Guiding Production in Rolling Mills by Means of Communicating and Signalling Systems.** Programming. Delivery of hot ingots. Main control stand. Working triangle: main control stand, pit furnaces, and cranes. Sequence of ingots and formation of cycles. Instructions for blooming mills. Control stand of the bloom shear. Communicating and signalling plants at open and continuous finishing trains. Communication systems at high-capacity finishing trains. Fundamentals of communicating and signalling plants. (*In German.*) Erzeugungslenkung in Walzwerken mit Nachrichten- und Signalanlagen. ***Herbert Brosch and Helmut Waburek.*** *Stahl und Eisen*, v. 79, no. 1, Jan. 8, 1959, p. 23-32.

5752* **Cutting Tools With High-Speed Steel Tips Glued on by Epoxide Resins.** The design and production of glued tools; results of tests. (*In Czech.*) Řezné nástroje s břitovými destičkami z rychlořezné oceli, nalepenými epoxydovými pryskyřicemi. ***O. Melezínek.*** *Strojírenská Výroba*, v. 6, no. 12, Dec. 1958, p. 535-539.

5753* **The Ascertaining of Microscopic Cracks in Sintered Carbide Tools.** (*In Czech.*) Zjišťování mikroskopických trhlin v nástrojích se slinutým karbidem. ***J. Kolář.*** *Strojírenská Výroba*, v. 6, no. 12, Dec. 1958, p. 540.

5754* **Cutters With Cemented Carbide Cutting Edges.** Geometry and fastening methods for milling cutter tips. (*In Czech.*) Frézy s břity ze slinutých karbidů. *Strojírenská Výroba*, v. 6, no. 12, Dec. 1958, p. 559-563.

5755* **Experience With the Use of Large Inserted-Tooth Cutters of Cemented Carbides for Milling of Steel.** Design of inserted-tooth cutters of a diameter up to 1000 mm., cutting conditions and results achieved. (*In Czech.*) Zkušenosti s používaním velkých frézovacích hlav s noži se slinutymi karbidy pro frézování oceli. ***F. Hummel.*** *Strojírenská Výroba*, v. 7, no. 1, 1959, p. 3-5.

5756* **Electro-Erosion Machining of Cemented Carbides.** Basic data about the method and examples of the process of machining various parts. (*In Czech.*) Elektro jiskrové obrábění slinutých karbidů. ***V. Vícha.*** *Strojírenská Výroba*, v. 7, no. 1, 1959, p. 11-14.

5757* **Evaluating Tool Life.** Statistical methods when applied to tool wear testing can predict performance quickly. Describes a useful technique and illustrates the principles with a report of a study performed on form-cutters used to machine slots. ***D. Peckner and H. Ginsburg.*** *Tool Engineer*, v. 42, no. 3, Mar. 1959, p. 75-79.

5758* **Crush-Form Grinding Saves Production Time.** Applied to surface, cylindrical, centerless and thread grinding operations. Making crush rolls; shaping wheels; grinding workpieces; wheel selection. ***H. Bert DiPaul.*** *Tool Engineer*, v. 42, no. 3, Mar. 1959, p. 84-86.

5759* **Improved Threading Techniques Simplify Production.** Threading methods for instruments and other precision units. Advantages of the processes, examples of successful applications, and the resultant savings. ***Richard Nyberg and Rodney Schultz.*** *Tool Engineer*, v. 42, no. 3, Mar. 1959, p. 90-92.

5760* **Reaming Accuracy Improved With Coolants.** Tests prove that the proper cutting fluid improves dimensional accuracy in addition to extending tool life. Steel, under proper conditions, has been found to machine like brass. ***B. L. ten Horn, R. A. Schuermann, and J. Staats.*** *Tool Engineer*, v. 42, no. 3, Mar. 1959, p. 93-99.

5761* **How to Cut Drilling Costs in Small-Plant Operations.** ***Clement F. Brown.*** *Tool Engineer*, v. 42, no. 3, Mar. 1959, p. 107-111.

5762* **Tool Evaluation Based on a Merit-Tool Performance Range.** Graphing cutting speed-tool life as a function of the range of performance and breakdown points clearly defines the limits of application of each tool material under examination, and portrays these performances relative to each other. ***Francis Cellier.*** *Tooling & Production*, v. 24, no. 11, Feb. 1959, p. 37-41.

5763* **Mechanized Stamping of Buick Stainless Trim.** Use of both overhead and horizontal extractors for unloading dies yields economies and helps to avoid scratching, thereby lowering polishing costs. Belts and pusher supplement other handling aids. ***Herbert Chase.*** *Tooling & Production*, v. 24, no. 11, Feb. 1959, p. 49-50.

5764* **Hard Spots in the Machined Surface.** Tries to explain how, while machining with feeds too fine, the cutting edges of milling cutters may slide over instead of cut the machined metal. These sliding cutting edges cold work the machined surface and thus form the hard spots. The very common phenomenon in finish milling steel with HSS milling cutters, known usually under the shop name of "hard spots", might not be due to any property of the machined metal, but simply to certain inappropriate working conditions. ***Antoni Niedzwiedzki.*** *Tooling & Production*, v. 24, no. 12, Mar. 1959, p. 57-59.

5765* **On the Action of Metal Cutting Fluids at Low Speeds.** Fluids used in metal cutting may be classified into those that are most useful at low speeds and act predominantly to improve surface finish, and those that are most useful at high speeds and act predominantly as coolants. The low speed materials function by reacting chemically with the chip to form a solid layer which prevents welding and metal transfer between chip and tool. ***Milton C. Shaw.*** *Wear*, v. 2, no. 3, Feb. 1959, p. 217-227.

See also: **5023** (grinding-wheel hardness testing); **5578** (lubrication of power presses); **5594** (design of transfer machine); **5597** (analysis of plastic strain in extrusion); **5693** (heat treatment of large forgings).

METALS—METALLOGRAPHY, TRANSFORMATIONS, AND STRUCTURES

5766 Cavity Formation in Nitrate-Doped Alkali Halides. Cavities filled with a gaseous product were formed after anneal in a hydrogen atmosphere. The experiments show that the gaseous products of a chemical reaction in a solid, precipitate along dislocations if enough activation is present to allow diffusion. Diffusion is facilitated by the formation of small agglomerates consisting of a few gas molecules and a number of vacancies. ***S. Amelinckx, W. Maenhout-Van der Vorst, and W. Dekeyser.*** *Acta Metallurgica*, v. 7, Jan. 1959, p. 8-17.

5767 The Kinetics of Cellular Segregation Reactions. Describes the growth of a cellular segregation reaction by two independent rate processes: the diffusion along the cell boundary, and the mobility of the cell boundary in response to the driving pressure which results from the decrease in free energy when the boundary moves and accomplishes segregation. The model was evaluated for two cases, precipitation from dilute solution and a symmetric eutectoid. ***J. W. Cahn.*** *Acta Metallurgica*, v. 7, Jan. 1959, p. 18-28.

5768 On Work-Hardening of Aluminium-Single Crystals (99.99%) and Its Interpretation. Temperature-dependence of work-hardening was investigated. The study was limited to two temperatures (+21 C and −195 C). With the measurements of stress-strain curves, observations of the surface patterns and X-ray asterism were combined. (*In German.*) Über die Verfestigung von Aluminium einkristallen (99,99% Al) und ihre Deutung. ***W. Staubwasser.*** *Acta Metallurgica*, v. 7, Jan. 1959, p. 43-50.

5769 Orientation of Recrystallized Grains in Strained Aluminum Single Crystals. Strained crystals were cut at one end and subjected to recrystallization heating. An overwhelming majority of the new crystals showed an orientation characterized by a 40° rotation around the [111] axis relative to the old matrix. Recrystallization always started at the cut end with many fine grains. After further heating most of these fine grains disappeared and only a few large crystals were left. They grew further into the deformed matrix and one of them finally occupied the full diameter of the wire. ***H. Yoshida, B. Liebmann, and K. Lücke.*** *Acta Metallurgica*, v. 7, Jan. 1959, p. 51-56.

5770* The Structure of Metals and the Strength of Structures. Effect of alloy structure on strength and ductility. ***Maxwell Gensamer.*** *American Institute of Mining, Metallurgical, and Petroleum Engineers, Transactions, Metallurgical Society*, v. 215, no. 1, Feb. 1959, p. 2-18.

5771* Microstructural Changes in a 42 Pct Ni, 30 Pct Cr, 26 Pct Fe Alloy During Creep-Rupture Testing. Microstructural characteristics were correlated with behavior in creep and rupture tests at 1400, 1600, and 1800 F. ***R. J. Raudebaugh and E. P. Sadowski.*** *American Institute of Mining, Metallurgical, and Petroleum Engineers, Transactions, Metallurgical Society*, v. 215, no. 1, Feb. 1959, p. 23-29.

5772* Microbeam Analysis of Widmanstätten Structure in Meteoritic Iron. The concentration and distribution of iron and nickel in the various phases of meteoritic iron were measured using an electron-probe microanalyzer. ***R. E. Maringer, N. A. Richard, and A. E. Austin.*** *American Institute of Mining, Metallurgical, and Petroleum Engineers, Transactions, Metallurgical Society*, v. 215, no. 1, Feb. 1959, p. 56-58.

5773* The Grain Boundary Adsorption of Solutes. The grain boundary adsorption of solutes as a function of bulk concentration and solution temperature was studied using internal-friction techniques. ***J. Winter and S. Weinig.*** *American Institute of Mining, Metallurgical, and Petroleum Engineers, Transactions, Metallurgical Society*, v. 215, no. 1, Feb. 1959, p. 74-82.

5774* Effect of Orientation on Strain-Induced Grain Boundary Migration in Silicon-Iron Bicrystals. Studies were made on a series of Si-Fe (3¼% Si) bicrystals of controlled orientation. ***K. T. Aust, E. F. Koch, and C. G. Dunn.*** *American Institute of Mining, Metallurgical, and Petroleum Engineers, Transactions, Metallurgical Society*, v. 215, no. 1, Feb. 1959, p. 90-96.

5775* Formation of Beta Manganese-Type Structure in Iron-Aluminum-Manganese Alloys. ***D. J. Schmatz.*** *American Institute of Mining, Metallurgical, and Petroleum Engineers, Transactions, Metallurgical Society*, v. 215, no. 1, Feb. 1959, p. 112-114.

5776* A Study of Reversion Phenomena in the Carbon-Alpha-Iron System. Results indicate that sudden increases in aging temperature lead to reversion phenomena in carbon in the α-iron system. ***D. Keefer and C. Wert.*** *American Institute of Mining, Metallurgical, and Petroleum Engineers, Transactions, Metallurgical Society*, v. 215, no. 1, Feb. 1959, p. 114-119.

5777* Grain Boundary Migration in High-Purity Lead and Dilute Lead-Tin Alloys. The motion of individual grain boundaries under a constant driving force was investigated for zone-refined lead, with and without solute tin additions. ***K. T. Aust and J. W. Rutter.*** *American Institute of Mining, Metallurgical, and Petroleum Engineers, Transactions, Metallurgical Society*, v. 215, no. 1, Feb. 1959, p. 119-127.

5778* The Nickel-Titanium-Carbon System. A tentative 870 C isothermal section, the solidus equilibria, and the solubility of TiC and graphite in the nickel solid solution were determined with arc-cast specimens. ***E. R. Stover and J. Wulff.*** *American Institute of Mining, Metallurgical, and Petroleum Engineers, Transactions, Metallurgical Society*, v. 215, no. 1, Feb. 1959, p. 127-136.

5779* Cellular Substructure in Zn Crystals Grown From the Melt. Evidence of (1) the effect of crystal orientation on some aspects of cellular growth, and (2) the degeneracy of these cells into dislocation arrays. ***V. Damiano and M. Herman.*** *American Institute of Mining, Metallurgical, and Petroleum Engineers, Transactions, Metallurgical Society*, v. 215, no. 1, Feb. 1959, p. 136-138.

5780* Stress-Induced Martensitic Transformation of Beta Titanium. Data from hardness and tensile tests were used to study the initiation of martensite and the effect of the transformation and transformation products on the mechanical properties of β titanium, particularly the stress-strain relationships. ***R. H. Hiltz, Jr.*** *American Institute of Mining, Metallurgical, and Petroleum Engineers, Transactions, Metallurgical Society*, v. 215, no. 1, Feb. 1959, p. 138-143.

5781* Electron Diffraction Study of Tempered Low-Carbon Martensite. An attempt to identify the initial carbide phase that forms on tempering martensite formed in a high-purity iron-carbon alloy containing 0.15% C. ***B. S. Lement.*** *American Institute of Mining, Metallurgical, and Petroleum Engineers, Transactions, Metallurgical Society*, v. 215, no. 1, Feb. 1959, p. 163-165.

5782* A Note on the Pd-B System. The Pd-B eutectic composition was determined. ***W. M. Lehrer.*** *American Institute of Mining, Metallurgical, and Petroleum Engineers, Transactions, Metallurgical Society*, v. 215, no. 1, Feb. 1959, p. 168-169.

5783 Change in Strength Coefficient Due to Martensite Formation in Plastic Deformation. The nature of the change in the strength coefficient in the deformation of austenitic steels is directly connected with differences in the resistance of austenite to the martensite transformation. The formation of martensite during plastic deformation increases the strength coefficient. Some features of the stress-strain curves of austenitic steels and alloys such as changes in the load, the presence of two maxima, etc., are attributable to the inter-relation between plastic flow and the formation of martensite. ***M. G. Gaidukov and V. D. Sadovskii.*** *Henry Brutcher Translation No.* 4214, 9 pp. (From *Metallovedenie i Obrabotka Metallov*, no. 5, May 1958, p. 4-8.) Henry Brutcher, Altadena, Calif.

5784 Aging of Creep-Resisting Nickel-Base Alloy EI437B Accelerated by Ultrasonic Vibrations. Ultrasonic vibrations of 20-26 kc/s accelerate the aging of the nickel-base EI437B alloy. Doubling the ultrasound energy in the specimen considerably increases the effect of ultrasound on aging of this alloy, and reduces the duration of aging to 2-2.5% of that for ordinary aging. Use of ultrasound during aging at 800 C even at low powers eliminates the effect of coalescence and hardens the alloy to the necessary level in 7 to 5% of the time normally required. ***V. S. Ermakov and E. A. Al'shan.*** *Henry Brutcher Translation No.* 4278, 11 pp. (From *Metallovedenie i Obrabotka Metallov*, 1958, no. 7, July, p. 22-27.) Henry Brutcher, Altadena, Calif.

5785 Recrystallization Diagram of Tantalum. Three-dimensional diagram connecting grain size with per cent reduction and temperature of subsequent anneal is constructed for

cold-rolled cast Ta ingots. ***E. M. Savitskii, M. A. Tylkina, and I. A. Tsyganova.*** *Henry Brutcher Translation No.* 4409, 6 pp. (From *Doklady Akad. Nauk SSSR*, v. 118, no. 4, 1958, p. 720-722.) Henry Brutcher, Altadena, Calif.

5786* Constitutional Diagrams of Uranium and Thorium Alloys. This cooperative compilation of United States and United Kingdom uranium and thorium constitutional diagrams is a highly useful source of reference material. It is divided into sections on uranium and thorium alloys. The systems are arranged in alphabetical order. ***Frank A. Rough and Arthur A. Bauer.*** 153 pp. 1958. Addison-Wesley, Reading, Mass. (QD181.U7 R75c Ref.)

5787 Dislocation Velocities, Dislocation Densities, and Plastic Flow in Lithium Fluoride Crystals. The growth of total dislocation density, the growth of individual glide bands, and the distribtuion of glide dislocations during plastic deformation are described. The yield stress of LiF is determined by the resistance to motion encountered by a glide dislocation in moving through an otherwise dislocation-free region of the crystal. The yield stress is independent of the dislocation present in an undeformed crystal, and the state of pinning and geometrical arrangement of such dislocations do not affect the yield stress. Stress-strain curves were calculated from the data on dislocation mobility and dislocation density, and the calculated and measured curves are compared. At low strains the flow stress can be predicted from measured dislocation properties. ***W. G. Johnston and J. J. Gilman.*** *Journal of Applied Physics*, v. 30, Feb. 1959, p. 129-144.

5788 Vaporization-Crystallization Method for Growing CdS Single Crystals. A self-refining method for growing three different forms of CdS single crystals is described together with fabrication details of the 1300-watt three-temperature zone furnace employed. The growth chamber measuring 1¾ in. in diameter x 21 in. long is charged with CdS powder and either H_2S or argon at a pressure of 1 atmosphere or less, and subjected from 4 to 7 days to different temperatures (1250 ± 2 C maximum) and gradients depending on the type of crystal desired. Single crystals vary from thin plates, rods, and whiskers weighing fractions of a gram to 10-g polygonal chunks. The method is believed to be suitable for growing single crystals of many other elemental and compound semiconductors. ***D. R. Boyd and Y. T. Sihvonen.*** *Journal of Applied Physics*, v. 30, Feb. 1959, p. 176-179.

5789 Investigation of an Alloy Surface With the Field Emission Microscope. The field emission microscope was used to investigate the surface of an alloy of a few percent Zr in Mo. The field emission patterns indicate that a high-temperature flash (2000 K) reduces the surface concentration of Zr to zero. Subsequent heat treatment at 1000 K brings Zr to the emitting surface where it adsorbs preferentially in small clusters on the lattice steps of the $\{100\}$ planes. These clusters are easily observed because of their high electron emission. Their emission characteristics reveal them to be smooth layers of low work function (2.94 ± 0.01 ev) rather than protruding crystallites. When the bulk concentration of Zr in the alloy is increased from 1% to 5% the emission patterns change markedly but there is little effect on the adsorption characteristics of the surface. Surface migration, desorption, and bulk diffusion of Zr were found to proceed rapidly at temperatures above 1200 K, 1500 K, and 2000 K, respectively. Measurements of activation energies for surface migration and desorption gave 2.7 ± 0.3 ev and 4.15 ± 0.15 ev, respectively. ***R. C. Bradley and L. A. D'Asaro.*** *Journal of Applied Physics*, v. 30, Feb. 1959, p. 226-233.

5790 Dislocation Etch Pits in Bismuth. Etch pits which are probably the sites of dislocations have been produced on the (111) cleavage plane of Bi. Evidence that the pits are dislocation sites was obtained from deformation and annealing studies and from density counts on intersecting boundaries. ***L. C. Lovell and J. H. Wernick.*** *Journal of Applied Physics*, v. 30, Feb. 1959, p. 234-235.

5791 Diffusion of Impurities Into Evaporating Silicon. Diffusion techniques have proven to be a powerful tool in the fabrication of device structures in semiconducting materials. This paper describes a diffusion technique in a vacuum system where the only ambient is the vapor of a diffusing impurity. Under these experimental conditions the rate of evaporation of silicon becomes significant and influences the diffusion of group III and group V elements. This evaporation affects the distribution of impurities in the solid and assures a surface of sufficient cleanliness for device fabrication. ***R. L. Batdorf and F. M. Smits.*** *Journal of Applied Physics*, v. 30, Feb. 1959, p. 259-264.

5792* Formation and Stability of the Epsilon Iron Nitride Phase. Morphological characteristics, mechanical properties, and formation velocity of nitrided layers on iron in different experimental conditions were studied. The N distribution in the surface layers and the effects of quenching and tempering on the stability of the nitrides was studied, particularly with reference to the ε-phase. (*In Italian.*) Formazione e stabilità della fase epsilon su ferro nitrurato. ***A. Burdese.*** *Metallurgia Italiana*, v. 50, Dec. 1958, p. 529-537.

5793 Phase Transitions in Two-Component Systems. Introduces four possible distribution functions in triplet space, expressed in terms of the pair-distribution functions, into the integro-differential equations. This results in four equations for the three-pair distribution functions in a binary mixture of molecules. ***E. L. Rubin.*** *Royal Society, Proceedings*, v. 249, ser. A, Jan. 13, 1959, p. 335-345.

5794 The Flow of Impurities to an Edge Dislocation. Derives the governing concentration equation, together with the relevant boundary conditions. A required exact, bounded solution applicable for low dislocation densities is obtained and used to deduce the number of atoms entering the dislocation core in time t. Comparisons are made with experimental results on strain aging of low-carbon steels. ***R. Bullough and R. C. Newman.*** *Royal Society, Proceedings*, v. 249, ser. A, Jan. 13, 1959, p. 427-440.

5795* A Theoretical Study of the Solid States for Crystals of the MB_6 Type. Crystal structure studies including valence bonds and symmetry-adopted molecular orbitals. ***Stig Flodmark.*** *Svensk Kemisk Tidskrift*, v. 70, no. 12, 1958, p. 521-527.

5796 Electron Metallographic Studies of Nickel-Base Heat-Resistant Alloys. Methods are described which have proven satisfactory for polishing and etching Ni-base alloys. Extraction replica techniques for isolating γ′ and carbide particles from the alloys for study by selected-area electron diffraction are given. Investigations were made to determine the nature of a banded structure which is associated with low rupture strength, and to study the influence of small additions of B and Zr on the precipitation of the γ′ phase. ***W. C. Bigelow and J. A. Amy.*** *U. S. Air Force, Wright Air Development Center, WADC Technical Report* 58-406, Aug. 1958, 49 pp. (TL507 Un3.18w Vis.)

5797* Investigations in the System Tantalum-Nitrogen. Recrystallized specimens of tantalum were loaded with different amounts of nitrogen in a homogeneous solution. These samples were used to study the dependence of hardness, tensile strength, yield point, dilatation, lattice parameter, electrical resistivity, and internal friction from the nitrogen concentration. Investigations were carried out, concerning the solubility of nitrogen in tantalum and the processes that occur when an oversaturated solid solution is cooled down to room temperature. (*In German.*) Untersuchungen im System Tantal-Stickstoff. ***Erich Gebhardt, Hans-Dieter Seghezzi, and Wolfgang Dürrschnabel.*** *Zeitschrift für Metallkunde*, v. 49, no. 11, Nov. 1958, p. 577-583.

See also: **5712** (structure of Be).

METALS—POWDER

5798* Hard Metal—The New Rock Drilling Medium. In percussion drilling, the average drilling "life" of a forged steel or detachable head is about 42 inches. A hard metal tip can be used at greater drilling speeds and has an average life of about 35 feet before re-sharpening is necessary. Describes manufacture and use of hard-metal tips. ***L. S. Cole.*** *Australasian Engineer*, 1959, Jan. 7, p. 70 + 2 pages.

5799 Sintering of Columbium Powder. Optimum conditions of sintering for ductile, easily cold-worked columbium metal. Variation of electrical resistivity, hardness, density, weight, and percentage of foreign elements in columbium powder compacts with sintering temperature. ***O. P. Kolchin and N. P. Chureleva.*** *Henry Brutcher Translation No.* 4415, 14 pp. (From *Tsvetnye Metally*, v. 13, no. 12, 1957, p. 67-70.) Henry Brutcher, Altadena, Calif.

5800 Growth of Sintered Metal Compacts. In contrast to the shrinkage which occurs on sintering pure metal powders, a growth effect is sometimes observed on subjecting mixtures of metal powders to a sintering treatment. The results are presented of a study of growth on sintering Fe-Cu and Cu-Sn mixtures, which takes into account the effect of such factors as powder characteristics, additions to the mixture, compact density and sintering conditions. ***J. E. Elliott.*** *Metallurgia*, v. 59, Jan. 1959, p. 17-27.

5801* Preparation of a Chromium Powder Suitable for the Production of Cermets. By reaction between Cr_2O_3 and Mg at 700 C in the presence of MgO, metallic Cr is obtained as a very fine powder. The MgO added at the beginning and that formed during the reaction, and excess Mg, are eliminated by washing with dilute HNO_3. The Cr content of the purified metallic powder is about 96%. (*In Italian.*) Preparazione di polvere di cromo atta alla produzione di metalceramici. ***G. Venturello and V. Coen.*** *Metallurgia Italiana*, v. 50, Dec. 1958, p. 538-540.

5802* Thermal Stability of Powder-Metallurgical Materials. Properties of high-temperature materials, including strength, thermal stability, resistance to thermal shock, plasticity, and resistance to oxidation. (*In German.*) Zur Warmfestigkeit pulvermetallurgischer Werkstoffe. ***I. N. Franzewitsch.*** *Neue Hütte*, v. 3, Dec. 1958, p. 732-739.

5803 Powder Metallurgy in Nuclear Engineering. Fifteen papers on powder preparation and fabrication of Be, Zr, U, Th, UO_2, and ceramic fuel materials. ***Henry H. Hausner, editor.*** 275 pp. 1958. American Society for Metals, Cleveland. (TN695 C76pm)

5804 Factors Affecting Sintering. ***L. L. Seigle and A. L. Pranatis.*** Paper from "Powder Metallurgy in Nuclear Engineering", p. 10-30, 1958. American Society for Metals, Cleveland. (TN695 C76pm)

5805 Alloying by Powder Metallurgy. Describes effects of processing variables on alloy formation and gives examples of application of the process to formation of U-Zr, U-Al, and other alloys. ***H. A. Saller and F. A. Rough.*** Paper from "Powder Metallurgy in Nuclear Engineering", p. 120-140, 1958. American Society for Metals, Cleveland. (TN695 C76pm)

5806 Custom Atomized Metal Powders. In recent years methods of atomization high temperature alloys of exceptional purity, low oxide content and controlled particle size and shape have been developed. These powders are finding wide use in such diverse applications as high temperature brazing in jet engine and rocket component parts, special corrosion resistant filters, new slip casting techniques for complex and intricate shapes, oxide dispersion hardening, porous media for sweat cooled applications, reactor fuel elements, etc. ***Gordon J. LeBrasse and Robert L. Probst.*** *Precision Metal Molding*, v. 17, Feb. 1959, p. 40 + 2 pages.

See also: **5604** (properties of carbide-base cermets).

NONDESTRUCTIVE TESTING AND QUALITY CONTROL

5807 Nondestructive Testing of Metals With Electromagnetic Instruments Using Probes. Describes a method of direct measurement of electrical conductivity in non-ferromagnetic materials by electromagnetic means, the Sigmatest instrument, including circuit and mechanical design. ***H. Breitfeld.*** *Henry Brutcher Translation No.* 4408, 27 pp. (From *Metall*, v. 9, nos. 1/2, 1955, p. 14-22.) Henry Brutcher, Altadena ,Calif.

5808* Radiographic Examination of Metal Structure Resulting From Static or Dynamic Deformation at Normal and Low Temperatures. (*In Czech.*) Rentgenografické zjišťování krystalické struktury kovů při statické a dynamické deformaci za normální a nízke teploty. ***J. S. Terminasov.*** *Hutnické Listy*, v. 14, no. 1, Jan. 1959, p. 43-47.

5809 Multichannel Swept Sonic Tester for Casting Quality Control. A brief analysis of the operating principles of multichannel swept sonic tester for casting quality control is presented. The results show that a force-driven, continuous-wave, swept-frequency sonic inspection of complex components is feasible. ***Norman W. Schubring and James E. Stevens.*** *IRE Transactions on Industrial Electronics, PGIE-8*, Jan. 1959, p. 46-58. (TK1 In6.6ie Vis.)

5810 Principles of Eddy Current Testing. A defective sample will cause the impedance of a test coil to vary; these variations can be measured to determine several properties such as hardness, tensile strength, diameter, conductivity, and permeability. ***Friedrich Foerster.*** *Metal Progress*, v. 75, no. 1, Jan. 1959, p. 101-105.

5811* Large-Scale Optical Inspection. Establishment of tooling points on a 40 ft. assembly fixture to within 0.001 in. in three co-ordinates in respect to a reference plane was necessary for the first DEW line radar antenna. ***John Wanner.*** *Metalworking Production*, v. 103, no. 5, Jan. 30, 1959, p. 184-185.

5812* Ultrasonic Weld Inspection. Many advantages of the technique are discussed. ***John E. Bobbin.*** *Nondestructive Testing*, v. 17, no. 1, Jan.-Feb. 1959, p. 26-28.

5813* Radiographic Inspection of Welded Turbine Wheels for Jet Starters. Covers the details of the inspection procedure and evolved standards used for welding evaluation of the turbine wheels. ***Albert R. Potenski.*** *Nondestructive Testing*, v. 17, no. 1, Jan.-Feb. 1959, p. 29-31.

5814* Ultrasonic Testing Procedures. Ultrasonic testing is a valuable nondestructive testing tool for determining the quality of stainless steels, tool steels and high temperature alloys, however, in its use or in writing specifications, certain characteristics must be carefully considered. ***J. B. Morgan.*** *Nondestructive Testing*, v. 17, no. 1, Jan.-Feb. 1959, p. 32-36.

5815* How to Keep Green Sand Quality Control on the Beam. Green sand for molding can be controlled for consistent performance once the inter-relationships of the various physical properties with the moisture and clay content are recognized. If one physical property of the sand is out of control, the sand may still be in control because of balancing effects of another property. ***A. Johnson.*** *Modern Castings*, v. 35, Feb. 1959, p. 34-36.

5816* Magnetic-Particle Inspection Paces Production Line at Griffin Wheel. High-speed magnetic-particle inspection equipment checks a cast steel car wheel every 60 seconds. ***A. J. Panozzo.*** *Modern Castings*, v. 35, Feb. 1959, p. 38-40.

5817 Inspection of Brazed Joints: A Statistical Evaluation of Some Nondestructive Methods. Methods are evaluated in an experiment designed for statistical analysis: X-ray, color-indicating paint, fluorescent paint, infrared camera, and resonant ultrasonics. ***R. R. Ruppender and E. G. Bianco.*** *Welding Journal*, v. 38, Feb. 1959, p. 90S-96S.

NUCLEAR PHYSICS, NUCLEONICS, AND RADIATION

5818* Britain's Advanced Gas-Cooled Reactor. The prototype, on which construction is about to start, is discussed together with some of the problems that have to be solved before the design is ready for commercial exploitation. ***R. V. Moore, H. Kronberger, and L. Grainger.*** *Atomic World*, v. 9, Nov. 1958, p. 376 + 3 pages.

5819* A High Thermal Efficiency Gas Cooled Nuclear Reactor. Shows that the thermal efficiency of a gas cooled reactor with gas-turbines can be increased by isothermal expansion of the coolant in appropriate cooling-channels of variable cross-section in the reactor core. (*In German.*) Über einen gasgekühlten Kernreaktor von hohem thermischem Wirkungsgrad. ***F. Winterberg.*** *Atomkernenergie*, v. 4, Jan. 1959, p. 2-6.

5820* Thermal Rate in Reactors. A relation for the highest thermal rate is deduced and the best possible values for the dimensions with regard to minimum work of the circulation-pumps are determined. (*In German.*) Wärmebelastung in Reaktoren. ***M. Ledinegg.*** *Atomkernenergie*, v. 4, Jan. 1959, p. 14-22.

5821 Solid and Liquid State Research With Cold Neutrons. Basic physical information from studies of the scattering of cold neutrons by matter is reviewed. Properties of the energy transfer processes and the information they yield concerning the thermal behavior of matter are emphasized, and experimental work discussed. ***P. A. Egelstaff.*** *British Journal of Applied Physics*, v. 10, Jan. 1959, p. 1-9.

5822 X-Ray Study of the Mineralogical Make-Up of Sinter. Importance of relationship between mineral composition of blast-furnace sinter and sinter quality. Identification of phases present. Procedure. X-ray diagrams of various fluxed and unfluxed sinters. ***A. G. Slabchenko.*** *Henry Brutcher Translation No.* 4407, 6 pp. (From *Zavodskaya Laboratoriya*, v. 24, 1958, no. 5, p. 579-582.) Henry Brutcher, Altadena, Calif.

5823 Metallurgy and Fuels. XI. Fissile and Fertile Materials. Reports on the 1958 Geneva Atomic Energy Conference. In this first article on metallurgy and fuels, the fissile and fertile materials, U, Pu, and Th and their compounds, are discussed. ***L. M. Wyatt.*** *Engineering*, v. 187, Jan. 23, 1959, p. 106-109.

5824 A Guide to Nuclear Energy. Attempts to explain to the non-specialist how nuclear reactors function. Includes a general description of the more important types now being constructed or studied including a description of the constructional materials of importance to the nuclear energy industry. ***R. F. K. Belchem.*** 77 pp. 1957. Philosophical Library, New York. (TK9202 B41g)

5825* A Level Scheme of $^{187}_{75}$Re. The disintegration: $^{187}_{74}W \rightarrow ^{187}_{75}Re$ has been studied by β spectrometry, γ spectrometry, β-γ and γ-γ coincidences, slow and fast. Transitions of: 72, 134, 206(?), 480, 552, 630, 686, 775, 866 keV have been found, corresponding to excited levels of: 134, 206, 630, 686, 775, 866 (or 1,000) keV. The 206 keV level, of period: $T\frac{1}{2} = 5.10^{-7}$ sec, is de-excited to the 134 keV level by a 72 keV transition that we have identified as being E 1 (Hindrance factor: $F = 3.5\ (\pm 1.5) \times 10^6$.) Spins and parities have been assigned for most of the levels. We propose a level scheme based on the whole experiemntal results. (*In French.*) Schéma de niveaux de $^{187}_{75}$Re. ***Michel Vergnes.*** *Journal de Physique et le Radium*, v. 19, no. 12, Dec. 1958, p. 947-956.

5826 Plutonium. General properties and applications. ***Bernhard Blumenthal.*** *Journal of Metals*, v. 11, Feb. 1959, p. 125-129.

5827* Reactor Element Processing Goes Automatic. High output and minimum handling requirements have led to installation of new semi-automatic transfer lines for machining and fabrication of canned U reactor fuel elements. *Metalworking Production*, v. 103, no. 5, Jan. 30, 1959, p. 199-203.

5828* Gamma-Rays From Inelastic Neutron Scattering in Na^{23}. Above were measured with neutron bombarding energies up to 3.7 MeV, and the modes of decay of the first six excited states were studied. ***Joan M. Freeman and J. H. Montague.*** *Nuclear Physics*, v. 9, no. 2, Dec. 1958, p. 181-197.

5829* Time Dependent Theory of Scattering of Nucleons by Nuclei. The optical model for scattering is derived from the general time dependent scattering theory. The exclusion principle is taken into account without approximations. A suitably defined single particle wave function satisfies a "Schrödinger equation" with a non-hermitian "optical potential" defined by an integral equation in terms of the two body interaction. ***F. Coester and H. Kümmel.*** *Nuclear Physics*, v. 9, no. 2, Dec. 1958, p. 225-236.

5830* Proton Distributions From $S^{32}(n, p)P^{32}$. Energy spectra of protons from natural sulfur bombarded with 14 MeV neutrons are shown at 0°, 30°, 60°, and 90°, obtained with a CsI scintillation spectrometer in coincidence with two particle-defining proportional counters. ***H. P. Eubank, R. A. Peck, Jr., and F. L. Hassler.*** *Nuclear Physics*, v. 9, no. 2, Dec. 1958, p. 273-286.

5831* Liquid Scintillation Counting for Tritium and Carbon-14. Problems involved in measuring low energy beta emitters by this new technique and its possible future applications in science and medicine. ***C. P. Haigh.*** *Nuclear Power*, v. 3, Dec. 1958, p. 585-587.

5832* Reactors. World Report January 1959. Tabular data are from papers presented at the Geneva 1958 conference and from other reliable published sources. *Nuclear Power*, v. 4, Jan. 1959, p. 113-120.

5833* Theory of Pulsed Neutron Experiments in Multiplying Media. The spatial and temporal distribution of thermal neutrons in a multiplying assembly following the introduction of a short burst of fast neutrons is investigated by means of an extension of the so-called "asymptotic reactor theory" to the time-dependent case. ***T. J. Krieger and P. F. Zweifel.*** *Nuclear Science and Engineering*, v. 5, Jan. 1959, p. 21-27.

5834* Nuclear Radiation Heating: Preliminary Design Considerations. Means for a quick engineering estimate of nuclear radiation heating effects exterior to reactors for preliminary flight vehicle design. ***Barney L. Byrum and John A. Biggerstaff.*** *Nuclear Science and Engineering*, v. 5, Jan. 1959, p. 28-31.

5835* Fast Fission Effect in Lattices of Natural Uranium and Heavy Water. The ratio of U^{238} to U^{235} fissions was measured for various natural uranium fuel assemblies in D_2O-moderated reactor lattices and relative decay rates were determined for the gamma activities of the U^{235} and U^{235} fission products. ***A. H. Futch, Jr.*** *Nuclear Science and Engineering*, v. 5, Jan. 1959, p. 61-67.

5836* Studies of the Spherical Harmonics Method in Neutron Transport Theory. ***W. Kofink.*** *Nuovo Cimento*, v. 9, ser. 10; Supplemento No. 2, 1958, p. 497-541.

5837 Levels of Cl^{33} From $S^{32}(p, p)S^{32}$ and $S^{32}(p, p'\gamma)S^{32}$. Differential cross sections for the elastic scattering of protons from S^{32} have been measured for the center-of-mass scattering angles 167.8°, 141.0°, 125.5°, 92.0°, and 63.9° for laboratory proton energies between 1.5 and 4.0 Mev. Other data are reported. ***J. W. Olness, W. Haeberli, and H. W. Lewis.*** *Physical Review*, v. 112, ser. 2, no. 5, Dec. 1, 1958, p. 1702-1716.

5838 High-Resolution Electron Spectroscopic Study of the 60-Hour Electron-Capturing Isomer Re^{182}. Many transitions are observed, including most of those reported by previous investigations on the beta decay of Ta^{182} to the same daughter nucleus W^{182}. In addition, many new transitions are observed. Using the Ta^{182} decay scheme as a base, it was possible to fit most of the new transitions into a plausible decay scheme involving several new levels. ***C. J. Gallagher, Jr. and J. O. Rasmussen.*** *Physical Review*, v. 112, ser. 2, no. 5, Dec. 1, 1958, p. 1730-1745.

5839 Safe Handling of Pyrophoric and Radioactive Metal Powders. ***W. B. Harris.*** Paper from "Powder Metallurgy in Nuclear Engineering", p. 242-260, 1958. American Society for Metals, Cleveland. (TN695 C76pm)

5840 Radioisotope Techniques. One of the major values of radioisotopes lies in their use as tools or aids in solving problems. An understanding of the versatility of these tools may be gained by considering some of the techniques that have been used in the past. Three applications of radioisotopes to the

solution of industrial-research problems are described; penetration of moisture into protective coatings, distribution of rare-earth additions in steel, and grinding-ball wear. ***G. D. Calkins.*** Paper from "Proceedings of the Inter-American Symposium on the Peaceful Application of Nuclear Energy May 1957", p. 293-299. (UF767 Un3ti Contin.)

5841 Proceedings of the Second United Nations International Conference on the Peaceful Uses of Atomic Energy, Held in Geneva September 1-13, 1958. v. II. Survey of Raw Material Resources. v. III. Processing of Raw Materials. Two of 33 volumes containing more than 2100 papers submitted. 843 and 607 pp. 1958. United Nations, Geneva. (QC770 In8p2 Over.)

5842 Second-Order Contamination in a Neutron Crystal Spectrometer. Contamination in the BNL spectrometer is measured and reflectivity calculations by Holm for neutrons incident on thin crystals of Be and NaCl are verified experimentally. ***R. Haas and F. J. Shore.*** *Review of Scientific Instruments*, v. 30, Jan. 1959, p. 17-21.

5843 Shape of the Nucleus. Nuclear shapes can vary rather widely, with doubly magic nuclei preferring spherical symmetry. Some nuclei execute volume-preserving oscillations about spherical shape, while others possess permanent spheroidal deformations. Pear-shaped nuclei may also exist. ***Lawrence Wilets.*** *Science*, v. 129, Feb. 13, 1959, p. 361-367.

5844 NASA Reactor Facility Hazards Summary. Report to inform the Advisory Committee on Reactor Safeguards of the U. S. Atomic Energy Commission concerning the design of the light water cooled and moderated of the MTR-type with a primary Be reflector and a secondary water reflector. Covers the reactor facility, characteristics of the site at the Plum Brook Ordnance Works near Sandusky, Ohio, and the hazards of operation at this location. ***T. M. Hallman and B. Lubarsky, editors.*** v. I. *U. S. National Aeronautics and Space Administration, NASA Memorandum* 12-8-58E, Jan. 1959, 384 pp. (TL782 Un3rm Vis.)

5845 Externally Cooled Liquid Metal Fuel Reactor Design Study. Two basic design concepts for an externally cooled Liquid Metal Fuel Reactor (LMFR) were investigated. One concept utilizes a single fluid, a uranium-thorium-bismuth slurry, as the coolant, fuel, and fertile material. The other concept incorporates a uranium-bismuth solution as the coolant-fuel in the core and a thorium-bismuth slurry as the coolant-fertile material in a blanket surrounding the core. ***C. E. Thomas, editor.*** *U. S. Atomic Energy Commission, BAW-1046*, Mar. 1958, 142 pp. (UF767 Un3.1ba Contin.)

5846 The Beta and Gamma Radiations of $_{35}Br_{47}^{82}$ and $_{37}Rb_{45}^{82}$ and the Energy Levels of $_{36}Kr_{46}^{82}$. The continuous β spectra as well as the internal conversion spectra were measured with the help of the magnetic solenoidal spectrometer. ***Noémie Benczer-Koller.*** *U. S. Atomic Energy Commission, CU-177*, May 29, 1958, 90 pp. (UF767 Un3.1cu Contin.)

5847 Fast Neutron Producing Reactions From N^{14} and N^{15}. The excitation curve for the above reaction at zero degrees has been measured from threshold at 3.78 Mev to 6.38 Mev bombarding energy. ***Jesse Leo Weil.*** *U. S. Atomic Energy Commission, CU-180*, Oct. 24, 1958, 79 pp. (UF767 Un3.1cu Contin.)

5848 Spert III Hazards Summary Report. Concludes that the proposed method of operation and the site location make possible the operation of the Spert III facility up to 2500 psi and 670 F without hazard to the general public. ***F. Schroeder.*** *U. S. Atomic Energy Commission, IDO-16425*, Jan. 14, 1958, 63 pp. (UF767 Un3.1id)

5849 Standard Practices Guide for Writing Experimental Operating Manuals. This is a sample operating manual designed to aid experimenters in writing operating manuals for MTR and ETR experiments. It contains what is felt to be the necessary information for operating a particular experiment. ***J. D. Ford, editor.*** *U. S. Atomic Energy Commission, IDO-16472*, Dec. 15, 1958, 31 pp. (UF767 Un3.1id Contin.)

5850 The Trichloroethylene-Saturated Water and the Tetrachloroethylene Chemical Dosimeter Systems. Preparation and Response to Gamma Radiation. Chemical dosimeter systems for measuring dose from about 5 to more than 1,000,000 rads in fast-neutron and gamma-radiation fields are presented. ***Donald G. Ott.*** *U. S. Atomic Energy Commission, LA-2249*, Jan. 21, 1959, 62 pp. (UF767 U3La Contin.)

5851 Scaling Spiral Sector FFAG Accelerators Without Median Plane Symmetry. Earlier work is extended to include the effects of magnet spiraling to find that a two-way accelerator with a circumference factor lower than that for conventional fields and with reasonable focusing properties can be made in this way. ***F. T. Cole.*** *U. S. Atomic Energy Commisison, MURA-437*, Dec. 4, 1958, 10 pp. (UF767 Un3.1mu Contin.)

5852 Comparative Measurements of the Velocity of Propagation of an Ultrasonic Pulse in Uranium Fuel Elements. The principles underlying the design of equipment for the above are discussed. ***Peter R. Morris.*** *U. S. Atomic Energy Commission, NLCO-764*, Nov. 24, 1958, 47 pp. (UF767 Un3.1nL Contin.)

5853 Homogeneous Reactor Project. Quarterly Progress Report. Reports work for periods ending April 30 and July 31, 1958. *U. S. Atomic Energy Commission, ORNL-2561*, Feb. 4, 1959, 338 pp. (UF767 U3o Contin.)

5854 The Oak Ridge Relativistic Isochronous Cyclotron. ***R. S. Livingston and F. T. Howard, editors.*** *U. S. Atomic Energy Commission, ORNL-2648*, Sept. 1958, 129 pp. (UF767 U3o Contin.)

5855 Major Factors Affecting Burn-Up of Nuclear Fuel Elements. Deals with problems of burn-up and reviews and analyzes the factors which determine the percentage of fissionable material in a nuclear fuel destroyed by fission or capture. Attempts have been made to correlate fuel element performance with design. ***M. Balicki, A. Machonis, and H. P. Kling.*** *U. S. Atomic Energy Commission, SCNC-268*, 24 pp. (UF767 Un3.1scn Contin.)

5856 Proceedings of the Inter-American Symposium on the Peaceful Application of Nuclear Energy, May 1957. Sponsored by the Government of the United States and conducted by Brookhaven National Laboratory under the auspices of the Atomic Energy Commission, the Department of State, and the International Cooperation Administration. *U. S. Atomic Energy Commission, TID-7554, (Book I)*, May 1957, 356 pp. (UF767 Un3ti Contin.)

5857 Phenomenology of Contained Nuclear Explosions. The phenomenology of the first explosion, code name "Rainier", is discussed, as it is now understood and the gross results of the more recent explosions are given. ***Gerald W. Johnson and Charles E. Violet.*** *U. S. Atomic Energy Commission, UCRL-5124* Rev. I, 28 pp. (UF767 U3u Contin.)

5858 Pion Production in Neutron-Proton Collisions at Bevatron Energies. Neutrons from a target bombarded by 6.2-Bev protons produced 330 three-prong and 34 five-prong events in a hydrogen-filled cloud chamber. These events were analyzed in an IBM program of constrained solutions. Frequencies for nine different particle configurations are estimated. ***Fred Nels Holmquist.*** *U. S. Atomic Energy Commission, UCRL-8559*, Dec. 4, 1958, 125 pp. (UF767 U3u Contin.)

5859 Pressurized Water Reactor (PWR) Project for the Period October 24, 1958 to December 23, 1958. Progress in power plant analysis and systems, reactor design, metallurgy, and physics are reported. *U. S. Atomic Energy Commission, WAPD-MRP-77*, 69 pp. (UF767 Un3.1wa Contin.)

5860* Search for Double β-Decay in Ca^{48}. Concludes that if double β-decay exists in Ca^{48} its half-life time must not be smaller than $0.7 \cdot 10^{19}$ years. (*In Russian.*) Poiski dvoĭnogo β-raspada v Ca^{48}. ***E. I. Dobrokhotov, V. R. Lazarenko, and S. Iu. Luk'ianov.*** *Zhurnal Eksperimental'noĭ i Teoreticheskoĭ Fiziki*, v. 36, no. 1, Jan. 1959, p. 76-87 + 1 plate.

5861* On Peripheral Interactions Between Elementary Particles. Can be phenomenologically described in an adequate manner by existing meson theory. It is suggested that the con-

tribution of peripheral interaction can be assessed by determining from experiment the amplitudes of various processes corresponding to large orbital angular momenta. (*In Russian.*) O periferiĭnykh vzaimodeĭstviiakh elementarnykh chastits. ***L. B. Okun' and I. Ia. Pomeranchuk.*** *Zhurnal Éksperimental'noi i Teoreticheskoi Fiziki*, v. 36, no. 1, Jan. 1959, p. 300-312.

See also: **4986** (applications of nuclear energy); **5088** (U^{233} purification and metal production); **5089** (ANL chemical engineering report, 1958); **5123** (nuclear reaction product analysis); **5258** (reactor design codes); **5562** (radioactivity measuring instruments); **5606** (nuclear power plant equipment); **5803** (powder metallurgy in nuclear engineering); **5882** (Clebsch-Gordan coefficients); **5916** (gas cooled reactors).

OPERATIONS RESEARCH AND MANAGEMENT ENGINEERING

5862 The Space Age Effect on Management. Predicts an "interesting and vexing" period before solutions are obtained. ***Edward A. Ledeen.*** *Aero/Space Engineering*, v. 18, Feb. 1959, p. 29 + 1 page.

5863* Preplanning for Electronic Inventory Control. The author considers preliminary questions that a prospective user of electronic data processing equipment should ask himself before commencing a formalized study of the details of the problem. ***Alfred James.*** *Automation*, v. 6, Feb. 1959, p. 70-74.

5864 The Philosopher—Executive. A discussion of research leadership is given. The adverse characteristics of some research leaders are described along with a delineation of the necessary qualities of an ideal research leader. ***R. G. H. Siu.*** *Electromechanical Design*, v. 3, no. 2, Feb. 1959, p. 26-33.

5865 Elementary Mathematical Programming. Emphasizing clarity, this book provides an elementary description of several methods of the mathematics of mathematical programming. The various methods are presented via typical yet simple problems in a logical step-by-step pattern. These problems have been carefully chosen to represent actual situations. Further examples illustrate, in detail, the techniques involved in formulation and analysis of solution methods. ***Robert W. Metzger.*** 246 pp. 1958. John Wiley & Sons, New York. (QA264 M56e)

5866* 5 Steps to a Plan That Will Really Measure Your Managers. ***Carl Heyel.*** *Factory*, v. 117, Feb. 1959, p. 62-67.

5867* Solving Your Plant Problems by Simulation. Application of Monte Carlo technique shows how maintenance and operations can be handled most efficiently. ***Paul Green, S. Reed Calhoun, and I. Landis Haines.*** *Factory*, v. 117, Feb. 1959, p. 80-85.

5868 Technical Management of Missile Systems. Capability and economy in complex missile systems demand fundamental changes in technical management. Of greatest importance is the complete involvement of senior technical personnel in conception and development, apart from auxiliary service and supervision. Formal organization and responsibility of the systems engineering staff provide the technical management key to this problem. ***T. J. Harriman.*** *IRE Transactions on Engineering Management*, v. EM-5, no. 4, Dec. 1958, p. 133-135. (TK1 In6.6em Vis.)

5869 Management Views Automation. A broad view of the changes automation is bringing into the economic life of the U. S. is given here. Without the fullest use of automation in all possible areas, our pre-eminent economic position cannot be carried forward into the world of tomorrow. ***Irven Travis.*** *IRE Transactions on Industrial Electronics, PGIE-8*, Jan. 1959, p. 59-62. (TK1 In6.6ie Vis.)

5870 Appreciating Depreciation. How a Noncash Expense Contributes to Corporation Funds. The importance of depreciation, as a source of cash rather than an expense, and of accelerated forms of depreciation which bring in the cash sooner for reinvestment by the company is shown. ***J. B. Weaver and W. E. Staudt.*** *Industrial and Engineering Chemistry*, v. 51, Feb. 1959, p. 65A-67A.

5871 Management Control of Small Engineering Firms. I. Building and Controlling a Management Team. II. Control of Production Engineering. III. Control of Finance and Costs. I. ***L. Fontaine.*** II. ***J. W. Walker.*** III. ***W. R. Spencer.*** *Institution of Mechanical Engineers, Proceedings*, v. 172, no. 9, 1958, p. 361-415.

5872* Statistical Decision Theory as a Method for Information Processing. The belief expressed here is that statistical decision theory provides both an enlightening and a unifying approach to problems concerned with decision making in the face of uncertainty. Statistical decision theory is by no means the last word on such problems—at least at its present state of development—but the approach seems to ask the right questions and accurately pinpoints the areas of difficulty. ***Harvey M. Wagner.*** *Journal of Industrial Engineering*, v. 10, no. 1, Jan.-Feb. 1959, p. 25-32.

5873* Inventory Control—Exploiting the Electronic Data Processor in the Air Force. ***Leon Gainen.*** *Journal of Industrial Engineering*, v. 10, no. 1, Jan.-Feb. 1959, p. 32-38.

5874* The Manufacturing Progress Function. The authors present initial empirical studies of manufacturing progress or, in other words, improved production effectiveness. ***R .W. Conway and Andrew Schultz, Jr.*** *Journal of Industrial Engineering*, v. 10, no. 1, Jan.-Feb. 1959, p. 39-54.

5875 The Management of Scientific Manpower. Management's objective is to combine educational, organizational, and operational techniques in such a way as to produce optimum output from today's limited scientific manpower resources. In this report, leaders of outstanding scientific programs in industry and the university describe current problems and practices in the basic functions of research and engineering management, from broad policy planning to recruiting, hiring, and development. ***Albert Newgarden, editor.*** 160 pp. 1958. American Management Association, New York. (HF5549 Am35m)

5876 "No Job Is Too Big . . ." The Multiple Organization—Management's Answer to Complexity. There are many commercial activities for which the multiple organization is well suited. Companies considering a joint venture could well find the multiorganization preferable to the conventional methods of merger, consolidation, or incorporation. ***Robert Hershey.*** *Management Review*, v. 48, Feb. 1959, p. 9 + 7 pages.

5877* An Executive's Viewpoint. Explains two subjects, the first being "why executives ought to use operations research" and the second being "why the use of operations research has not grown faster". ***Thomas M. Ware.*** *Operations Research*, v. 7, no. 1, Jan.-Feb. 1959, p. 1-9.

5878* On a Linear-Programming, Combinatorial Approach to the Traveling-Salesman Problem. This approach affords a practical means of computing optimal tours in problems that are not too huge. ***G. B. Dantzig, D. R. Fulkerson, and S. M. Johnson.*** *Operations Research*, v. 7, no. 1, Jan.-Feb. 1959, p. 58-66.

5879 Personnel Administration. A Point of View and a Method. The central theme of the two earlier editions of this book, that personnel administration, although a staff function, is a line responsibility, is still stressed. The new edition emphasizes organizational planning and executive development, progress in line-staff and union-management relationships, surveys of employee morale and "economic education" for employees. The authors are professors in the Industrial Relations Section of the Department of Economics and Social Science, Massachusetts Institute of Technology. ***Paul Pigors and Charles A. Myers.*** 3rd Ed. 711 pp. 1956. McGraw-Hill, New York. (HF5549 P62p)

5880* Fundamentals That Are Necessary in All Training Programs. ***Russell W. Davis.*** *Plant*, v. 19, Feb. 1959, p. 59-60.

5881 Some Aspects of Consultant Engineering in the United States. In 1956, the Organization for European Economic Cooperation sent engineers from seven countries to the

United States to study the working methods and conditions of American consulting engineers. It was felt that more could be known about such activities, and that the knowledge gained might well contribute towards increasing the ability of Europe to compete in the world's export markets. The results appear in this study. 116 pp. 1958. Organisation for European Economic Co-Operation, Paris. (TA157 Or4s)

5882 Relocatable Soap-II Subroutine for Finding Clebsch-Gordan Coefficients. An outline of the nature and use of a subroutine for computing Clebsch-Gordan coefficients has been written for the IBM-650 Augmented Data Processing System. ***Marjory C. Simmons.*** *U. S. Atomic Energy Commission, UCRL-8554,* Nov. 25, 1958, 5 pp. (UF767 U3u Contin.)

ORE AND MATERIALS BENEFICIATION

5883* Water Conservation in Industry. Types of Water Cooling Towers. Design, performance, construction, selection of materials. ***Basil S. Elms.*** *Australasian Engineer,* 1959, Jan. 7, p. 76-77.

5884 The Flotation of Fluorite—A Review. The main principles of the production of acid grade fluorite by flotation. ***W. J. Trahar.*** *Australia, Commonwealth Scientific and Industrial Research Organization, Ore-Dressing Investigations, Information Circular No.* 4, May 1958, 14 pp. (TN500 Au78.2i Vis.)

5885 Production of Fluxed Sinter and Its Use in the Blast Furnace. ***A. P. Yakobson.*** *Henry Brutcher Translation No.* 4384, 24 pp. (From *Stal',* v. 15, no. 1, 1955, p. 11-18.) Henry Brutcher, Altadena, Calif.

5886 Flash Roasting of NF Sulfide to Sulfate Ores. Design details of pilot plant. Sulfating roasting of a Cu concentrate. Effect of excess air, roasting temperature, and bed depth. Flash roasting of Cu-Zn concentrate. ***G. Ya Leizerovich, I. S. Lonskii, and V. Z. Charnyi.*** *Henry Brutcher Translation No.* 4411, 4 pp. (Condensed Translation from *Tsvetnye Metally,* v. 13, no. 9, 1957, p. 19-25.) Henry Brutcher, Altadena, Calif.

5887 Sinter Mixes Preheated in Mixing Drums. Increasing sinter production 3.5-3.8% by preheating of sinter mixes in mixing drums to about 120 F. ***D. A. Kissin, V. E. Ioffe, B. A. Stanishevskii, and N. S. Karpushinskii.*** *Henry Brutcher Translation No.* 4414, 8 pp. (From *Stal',* v. 18, no. 10, 1958, p. 867-869.) Henry Brutcher, Altadena, Calif.

5888 Effect on Reagent Consumption of Recycling Solutions in the Weak Acid Leaching of a Uranium Ore. Studies the possibility of reducing the acid requirements in the leaching of U ores at controlled pH, by recycling a portion of the leach liquor as make-up solution with fresh ore. ***V. M. McNamara and W. A. Gow.*** *Canada, Mines Branch, Research Report* R-28, Nov. 14, 1958, 20 pp. (TN26 C16.5r Contin.)

5889 Studies on the Separation of the Rare Earths From Thorium in Sulphate Solutions, Using Cation Exchange Resins. An ion exchange method for the separation of the rare earth elements from Th, based on the difference in the extent of complexing of the metal ions by sulphate ions in aqueous solution. ***D. C. Lewis and J. C. Ingles.*** *Canada, Mines Branch, Research Report,* R-31, Oct. 6, 1958, 40 pp. (TN26 C16.5r Contin.)

5890* Extraction of Selenium From Pyrite. A small diameter lead or porcelain hydrocyclone is used with advantage in separating the sludge from the acid. A small pump is used to drive the sludge through a multiclone. Another multiclone is used to further concentrate the acid content. Pure red Se is recovered in settling tanks, filtered, washed and dried. (*In German.*) Gewinnung von Selen aus Pyrit. ***Rudolf Kaiser.*** *Chemische Technik,* v. 11, no. 1, Jan. 1959, p. 34-35.

5891 Improving Coking Coal Quality. Increased strength and yield of coke and an ensuing boost in blast-furnace output result from upgrading blend of three high volatile coals in new 600-tph cleaning-in-transit preparation plant of U. S. Steel. ***R. M. von Storch.*** *Coal Age,* v. 64, Feb. 1959, p. 112-116.

5892* Extraction of Uranium From Minerals. Review of the problem and abstracts of several studies. (*In French.*) L'extraction de l'uranium des minerais. ***P. Mouret and J. Morand.*** *Énergie Nucléaire,* v. 2, no. 4, Oct.-Dec. 1958, p. 293-300.

5893 Metal and Mineral Processing. Latest improvements. ***James W. Franklin.*** *Engineering and Mining Journal,* v. 160, Feb. 1959, p. 156-158.

5894 New 5000 Tons Per Day Ore Sintering Plant at U. S. Steel's Ohio Works. Description of the plant. *Industrial Heating,* v. 26, Jan. 1959, p. 86 + 6 pages.

5895 Recovery of Semi-Heavy Minerals in Jigs. The significance of the recovery efficiency of jigs is discussed in relation to certain ore-dressing practices and to the mining and treatment of alluvial, residual, and primary ore deposits. ***F. A. Williams.*** *Institution of Mining and Metallurgy, Bulletin,* no. 627, Feb. 1959; *Transactions,* v. 68, pt. 5, 1958-1959, p. 161-175.

5896 Santa Barbara Mill, Chihuahua, Mexico. Describes various crushing plants serving the mill, gives a detailed account of the concentrator flowsheet, which employs two-stage grinding followed by the selective flotation of Pb, Zn, and Cu. Tailings disposal is dealt with in some detail. Brief review of metallurgical control and summarized cost data is given. ***Derek C. Shelton.*** *Institution of Mining and Metallurgy, Bulletin,* no. 627, Feb. 1959; *Transactions,* v. 68, pt. 5, 1958-1959, p. 177-192.

5897* On the Design of a Hindered Settling Classifier With Periodical Discharge of Classes. Description and design—calculation of the classifier. (*In Russian.*) K voprosu rashcheta klassifikatora stesnennogo padeniia s periodicheskoĭ razgruzkoĭ klassov. ***P. F. Eremin.*** *Izvestiia Vysshikh Uchebnykh Zavedenii, TSvetnaia Metallurgiia,* 1958, no. 5, p. 18-26.

5898 Separation of Metal Ions by Means of Ion Exchange Membranes. I. Separation of Rare Earth Mixtures, and of Thorium-Rare Earth Mixtures Using Ethylenediaminetetraacetic Acid. Good separations are obtained in mixtures of La, Pr and Nd as well as of Th and Nd. The influence of perchlorate, chloride, nitrate and acetate is studied. ***K. Bril, S. Bril, and P. Krumholz.*** *Journal of Physical Chemistry,* v. 63, Feb. 1959, p. 256-259.

5899* Mineral Dressing. Progress made in the search for improved and lower-cost methods of ore treatment. One field of mineral dressing is emphasized by the author—iron ore beneficiation—where new developments carry great hope for reduced costs in the steel industry. ***Louis J. Erck.*** *Mining Congress Journal,* v. 45, Feb. 1959, p. 58-61.

5900* Strategic Minerals. There are a few bright spots, but the future outlook for some domestic commodities, such as Hg and fluorspar, is dim—particularly in view of the termination of purchases for the Government stockpile. ***F. A. McGonigle.*** *Mining Congress Journal,* v. 45, Feb. 1959, p. 109-111.

5901 Beneficiation of Autunitic Ores. Experiments have developed a highly successful collector for this mineral component of a low grade U ore. ***William C. Aitkenhead and John A. Jaekel.*** *Mining Engineering,* v. 11, Jan. 1959, p. 66-67.

5902 Gravity Methods Clean Extreme Fine Sizes of Bituminous Coal. Low-cost recovery and simple operation, with reduced ash and S content in the yield of clean coal. ***H. B. Charmbury and D. R. Mitchell.*** *Mining Engineering,* v. 11, Feb. 1959, p. 211-214.

5903 Sphalerite Flotation With Guanidine Compounds and Derivatives as Collectors. The diphenyl and dibutyl derivatives of both urea and guanidine are excellent flotation collectors. ***Pierre R. Hines.*** *Mining Engineering,* v. 11, Feb. 1959, p. 219-220.

5904* Cyanamid Floats Coarse Phosphate. Coarse particles in washing plant tailing are floated with fuel oil, crude tall oil, and caustic soda. Concentrate is cleaned by floating

away silica particles with Aeromine 3037. ***A. E. Roberts.*** *Mining World*, v. 21, no. 2, Feb. 1959, p. 32-36.

5905* Why Moving Bed Ion Exchange System Was Selected. Instrumentation and control of the first U mill in the United States to use moving ion bed. ***Stanley H. Dayton.*** *Mining World*, v. 21, no. 2, Feb. 1959, p. 42-45.

5906* Petrographic Enrichment of Coal in the Process of Flotation With Salt. Industrial tests of flotation with salt showed that this process is effective when sulfurated kerosene (400 to 500 gr/ton) and electrolytes are used. (*In Russian.*) Petrograficheskoe obogashchenie uglia v protsesse solianoĭ flotatsii. ***M. G. El'iashevich.*** *Nauchnye Doklady Vysshei Shkoly, Gornoe Delo*, 1958, no. 4, p. 213-217.

5907* Effect of Soluble Salts Contained in Coals on Their Flotation. Preliminary dissolving of salts improves flotation. (In *Russian.*) Vliianie rastvorimykh soleĭ, soderzhashchikhsia v ugliakh, na flotatsiyn poslednikh. ***V. I. Klassen and K. P. Kovachev.*** *Nauchnye Doklady Vysshcĭ Shkoly, Gornoe Delo*, 1958, no. 4, p. 241-246.

5908* Synthesis and Trials in Using Certain Esters of Thio-Carbonic Acids in the Process of Flotation of Galena and Sphalerite. Monoesters of tri-thio-carbonic acid are potent reagents for galena and sphalerite, almost equal to xanthates. (*In Polish.*) Synteza i próby zastosowania estrów niektórych kwasów tiowęglowych do flotacji galeny i blendy cynkowej. ***K. Żmudziński and J. Wójtowicz.*** *Prace Instytutów Hutniczych*, 1958, no. 6, p. 361-367.

5909* Representation of Cleaning Results. Description of raw coal. Washability curves, and the cleaning results. (*In French.*) Représentation des résultats d'une séparation. ***R. J. Testut.*** *Revue de l'Industrie Minérale*, v. 51, Spec. Issue, Dec. 15, 1958, p. 32-44.

5910* On the Collective Action of the Collectors in Flotation Process. Critical review of articles by V. A. Glembovitskiĭ on this problem. (*In Russian.*) K voprosu o sovmestnom deĭstvii reagentov-sobirateleĭ pri flotatsii. ***I. N. Shorsher.*** *Tsvetnye Metally*, v. 31, no. 12, Dec. 1958, p. 11-14.

5911* A Method of Fluo Solid Roasting of Zinc Concentrates With the Simultaneous Recovery of Lead and Cadmium. Tests at the Gintsvetmet showed that this method can be efficiently used for the pyrometallurgical production of Zn. Its advantages are: elimination of sintering refining, additional extraction of Cd and Pb, obtaining gases with a high SO_2 content, and intensification of roasting. (*In Russian.*) Metod obzhiga tsinkovykh kontsentratov v kipiashchem sloe s odnovremennym otgonom svintsa i kadmiia. ***I. V. Babina and A. D. Besser.*** *Tsvetnye Metally*, v. 31, no. 12, Dec. 1958, p. 20-24.

5912* Some Peculiarities in Oxidizing Roasting of Gold Bearing Sulphide Concentrates. Studies effect of temp. on the roasting characteristics of the concentrates and on the extraction of Au. Determination of the optimum roasting temp. = 500 C. Maximum Au extraction does not require full desulfurization at roasting. (*In Russian.*) Nekotorye osobennosti okislitel'nogo obzhiga sul'fidnykh zolotosoderzhashchikh kontsentratov. ***V. V. Lodeĭshchikov.*** *Tsvetnye Metally*, v. 31, no. 12, Dec. 1958, p. 51-56.

5913 Laboratory and Pilot Plant Evaluation of Dyno Uranium Concentrate. *Nelson R. Leist, Clark T. Hicks, and Joseph R. Nelli.* *U. S. Atomic Energy Commission, NLCO-767*, Oct. 31, 1958, 25 pp. (UF767 Un3.1nL Contin.)

5914 Recovering Mercury From Cinnabar-Stibnite Ore by Flotation and Fluidized-Bed Roasting. Results of laboratory investigations by the Alaska Mining Experiment Station to determine the practicability of treating cinnabar-stibnite ore by bulk flotation and controlled-atmosphere roasting of the concentrate. ***R. R. Wells, M. M. Johnson, and F. T. Sterling.*** *U. S. Bureau of Mines Report of Investigations* 5433, 1958, 19 pp. (TN21 Un3r Vis.)

See also: **5446** (new uranium beneficiation treatments); **5456** (waterflood performance); **5841** (raw materials processing).

PHYSICS

5915 On the Coefficient of Absorption (Attenuation) of β-Rays in Semiconductors. Studies on S, Se, Te, Ge, InSb, GaSb, HgSe, CdTe, ZnTe, PbTe, and PbSe. (*In Russian.*) O koeffitsiente pogolshcheniia (oslableniia intensivnosti) betalucheĭ v poluprovodnikakh. ***B. I. Boltaks and V. I. Sokolov.*** *Akademiia Nauk SSSR, Doklady*, v. 123, no. 3, Nov. 21, 1958, p. 446-448.

5916* The Pyrometric Calculation of Gas Cooled Reactors. Equations governing the relations between power, gas temperatures, pressure-drop, and pumping power for a single channel are presented graphically in a diagram called "channel-characteristic" by which various possibilities for the gas-distribution to the cooling channels can be examined. (*In German.*) Über die wärmetechnische Berechnung gasgekühlter Reaktoren ***Hans Dieter Baehr.*** *Atomkernenergie*, v. 4, Jan. 1959, p. 7-11.

5917 Paramagnetic Spectra of Substituted Sapphires. I. Ruby. Numerically computed energy levels and their associated eigenvectors, are presented as a function of applied magnetic field for various orientations of the magnetic field with respect to the crystalline symmetry axis. ***E. O. Schulz-Du Bois.*** *Bell System Technical Journal*, v. 38, no. 1, Jan. 1959, p. 271-290.

5918 Paramagnetic Resonance Spectrum of Cr^{+++} in Emerald. The large value of the spectroscopic splitting factor, D observed suggests the possible use of emerald as an active material in relatively high microwave-frequency solid-state masers. ***J. E. Geusic, Martin Peter, and E. O. Schulz-Du Bois.*** *Bell System Technical Journal*, v. 38, no. 1, Jan. 1959, p. 291-296.

5919 Theorem Concerning Anisotropic Dielectrics. Theorem enables the perturbation effects of an anisotropic dielectric cylinder set in a general two-dimensional electric field to be written down. ***G. Power.*** *British Journal of Applied Physics*, v. 10, Jan. 1959, p. 32-34.

5920* The Concept of Order. IV. Quantum Mechanics. Reformulation resolves some difficulties in the foundations of quantum theory and gives a new picture of an elementary particle. ***E. W. Bastin and C. W. Kilmister.*** *Cambridge Philosophical Society, Proceedings*, v. 55, pt. 1, Jan. 1959, p. 66-81.

5921* Two Bodies at Rest in General Relativity. Shows, by the construction of a complete physically sensible model, that static two-body solutions do exist for systems in which one body is hollow and contains the other. ***L. Marder.*** *Cambridge Philosophical Society, Proceedings*, v. 55, pt. 1, Jan. 1959, p. 82-86.

5922* Magnetohydrodynamics. A study of the interaction of the electromagnetic field with liquid or gaseous conductors treated as continuum. Fundamental equations, propagation of small disturbance. Reinforcing the magnetic field. Hydromagnetic dynamo. Stability problems. (*In German.*) Magnetohydrodynamik. ***S. I. Syrovatskij.*** *Fortschritte der Physik*, v. 6, no. 9, 1958, p. 437-503.

5923* A Contribution to the Study of the Intermolecular Forces in Connection With the Equation of State of Gases and the Disturbances of the Spectrum Lines Under High Pressure. Interactions between 2,3 and 4 molecules in the case of the intermolecular Herzfeld potential. Calculation of the fourth coefficient of the virial by a new method. Effect of the more precise Buckingham potential on the equation of state. Third coefficient of the virial and comparison with experimental data. (*In French.*) Contribution a l'étude des forces intermoléculaires en liaison avec l'équation d'état des gaz et les perturbations des raies spectrales sous haute pression. ***René Bergeon.*** *Journal des Recherches du Centre National de la Recherche Scientifique*, no. 44, Sept. 1958, p. 171-207.

5924* Term Analysis of the Second Spectrum of Rhenium (Re II). Wavelengths and estimated intensities of approximately 2,000 spectral lines emitted by singly ionized rhenium atoms were available for this analysis. Observed Zeeman patterns for 220 Re II lines facilitated finding and interpreting the first energy levels. ***William F. Meggers, Miguel A. Catalan, and Manuel Sales.*** *Journal of Research, National Bureau of Standards*, v. 61, no. 6, Dec. 1958, p. 441-461.

5925 Measurement of the Falling Velocity of Particles in Opaque Fluids. An apparatus is described for the measurement of the falling velocity of small metallic or metal-coated particles through opaque fluids. An electromagnetic method of detecting the particles is employed. ***V. Fidleris and R. L. Whitmore.*** *Journal of Scientific Instruments*, v. 36, Jan. 1959, p. 35-36.

5926* Rotational Effect on the Thermodynamic Properties of Isotopes. Shows that the differences in the thermodynamic properties of $H\equiv$ and D_2 is due to the fact that, for the same total mass, the distribution of mass between the two atoms is not the same which introduces a correlation between translational and rotational degrees of freedom. ***Agnessa Babloyantz.*** *Molecular Physics*, v. 2, no. 1, Jan. 1959, p. 39-48.

5927 A Geometrical Approach to the Structure of Liquids. ***J. D. Bernal.*** *Nature*, v. 183, Jan. 17, 1959, p. 141-147.

5928* The Inversion Problem in Wave Mechanics and Dispersion Relations. The analytical properties of the eigensolutions of a wave equation as function of the energy, considered as a complex variable, give a new derivation of the so called Gel'fand and Levitan integral equation. ***Mario Verde.*** *Nuclear Physics*, v. 9, no. 2, Dec. 1958, p. 255-266.

5929* On the Theory of Higher Spin Fields. Covers free fields, the spin projection operator, electromagnetic interactions, wave equation for spin 3/2, and other factors. ***C. Fronsdal.*** *Nuovo Cimento*, v. 9, ser. 10; Supplemento No. 2, 1958, p. *Nuovo Cimento*, v. 9, ser. 10; Supplemento No. 2, 1958, p. 416-443.

5930 Thermal Excitations in Liquid He^3. The constant-volume heat capacity of the saturated liquid has been evaluated. This elementary heat capacity $C_v(T)$ was found to exhibit at least three inflection points over the temperature interval extending to the critical temperature. ***Louis Goldstein.*** *Physical Review*, v. 112, ser. 2, no. 5, Dec. 1, 1958, p. 1465-1482.

5931 Isotope Effect on the Superconducting Transition in Lead. Lead specimens of different isotopic mass are used. Measurements are made using the Meissner effect and a ballistic induction method in the range from 7.2 to about 1.4 K. ***R. R. Hake, D. E. Mapother, and D. L. Decker.*** *Physical Review*, v. 112, ser. 2, no. 5, Dec. 1, 1958, p. 1522-1532.

5932 Influence of Mass Ratio on Displacement Cascades in Diatomic Solids. The effect on a cascade initiated when an atom of a solid of type *AB* receives considerable energy is investigated for a simple model. With some assumptions, comparatively simple equations are obtained and solutions which are always approximately correct have been found by the Laplace transform method. The total number of displacements does not vary greatly with mass ratio. ***E. M. Baroody.*** *Physical Review*, v. 112, ser. 2, no. 5, Dec. 1, 1958, p. 1571-1576.

5933 Dependence of Sound Velocity and Attenuation on Magnetization Direction in Nickel at High Fields. Changes in the velocity of 10 Mc transverse waves of the order of 0.1% were observed when the crystal was rotated about a crystallographic axis in a magnetic field high enough to allow saturation of the elastic constants. ***G. A. Alers, J. R. Neighbours, and H. Sato.*** *Physics and Chemistry of Solids*, v. 9, no. 1, Jan. 1959, p. 21-27.

5934 The Faraday Effect in Semiconductors. At low magnetic field strengths and low frequencies the Faraday rotation, θ is determined by the d.c. conductivity δ_0 and the Hall coefficient R_0 and is proportional to $\delta_0^2/^2R_0$. At high frequencies θ depends on the electron distribution and other factors. ***M. J. Stephen and A. B. Lidard.*** *Physics and Chemistry of Solids*, v. 9, no. 1, Jan. 1959, p. 43-47.

5935 The Electronic Structure of an H-Center. The structure of a new type of color center, which is produced in KCl, KBr, and LiF crystals by X-irradiation at low temperatures, has been determined by electron-spin-resonance experiments. ***Werner Känzig and Truman O. Woodruff.*** *Physics and Chemistry of Solids*, v. 9, no. 1, Jan. 1959, p. 70-92 + 1 plate.

5936 The Properties of Gases and Liquids. Critically reviews methods useful in correlating or estimating the more important physical properties of pure materials and simple mixtures. Treats estimation of critical pressure, critical temperature, critical volume, compressibility (P-V-T relations), vapor pressure, latent heat of vaporization, heats of formation, free energies, heat capacities, viscosity, thermal conductivity, diffusion coefficients, and vapor-liquid equilibrium by both theoretical and empirical methods. ***Robert C. Reid and Thomas K. Sherwood.*** 386 pp. 1958. McGraw-Hill, New York. (TP242 R27p)

5937 Accelerated Self-Constricted Electron Streams in Plasma. Finds when electron-positive ion collisions are taken into account, that for dense streams in low electric fields the radial oscillations (pinch oscillations) can destroy the streaming character of the electron flow and thus prevent its acceleration. ***J. G. Linhart.*** *Royal Society, Proceedings*, v. 249, ser. A, Jan. 13, 1959, p. 318-334.

5938 Theory of Cusped Geometries. II. Particle Losses. The computation of particle losses through a line cusp is performed under the assumption that there is a good approximation to a sharp boundary separating the field-free plasma from the vacuum magnetic field. ***Jerome Berkowitz.*** *U. S. Atomic Energy Commission, NYO*-2536, Jan. 6, 1959, 21 pp. (UF767 U3ny Contin.)

5939 Theory of Cusped Geometries. I. General Survey. A survey of the more important theoretical aspects of those cusped geometries which may be feasible as thermonuclear devices. ***Harold Grad.*** *U. S. Atomic Energy Commission, NYO*-7969, Dec. 1, 1957, 49 pp. (UF767 U3ny Contin.)

5940 On Vacuum Magnetic Fields in a Torus With Multipolar Windings. Results are applied to the Model C stellarator. ***John L. Johnson.*** *U. S. Atomic Energy Commission, NYO*-8051, Aug. 27, 1958, 53 pp. (UF767 U3ny Contin.)

5941 High Intensity Light Sources. II. The method described has been used for determining the brightness temperatures of some available light sources. Sodium, thallium, and mercury discharge lamps, a medium-pressure mercury arc lamp, and the carbon arc were studied. ***Earl Fremont Worden, Jr.*** *U. S. Atomic Energy Commission, UCRL*-8509, Oct. 9, 1958, II-107 pp. (UF767 U3u Contin.)

5942 Wave Optics. Interference and Diffraction. Treatment in this book lies intermediate between the elementary and more advanced accounts already available. A fairly comprehensive account of the subject, lucid and not too mathematical, has therefore been attempted. ***C. Curry.*** 155 pp. 1957. Edward Arnold Publishers, Ltd., London. (QC403 C93w)

5943* Frequency Spectrum of Double Spin-Resonance at Coloration Centers in Alkali-Halide Crystals. The angular dependences are determined by the structure of the center and can be employed for a direct experimental study of the structure of the above. (*In Russian.*) Spektr chastot dvoinogo spin-rezonansa na tsentrakh okraski shchelochno-galoidnykh kristallov. ***V. Ia. Zebin.*** *Zhurnal Eksperimental'noi i Teoreticheskoi Fiziki*, v. 36, no. 1, Jan. 1959, p. 116-128.

5944* On the Energy Spectrum of the Mott Exciton in Ionic Crystals. A many-electron investigation of the exciton reduces to the problem of motion of two quasi-particles which interact with coulomb forces in the case of triplet states (ortho exciton) and with coulomb and exchange forces in the case of singlet states (para-exciton). (*In Russian.*) Ob energeticheskom spektre eksitona motta v ionnykh kristallakh. ***S. A. Moskalenko and K. B. Tolpygo.*** *Zhurnal Eksperimental'noi Teoreticheskoi Fiziki*, v. 36, no. 1, Jan. 1959, p. 149-163.

See also: **5013** (magnetic properties of Mn ferrite); **5852** (propagation of ultrasonic pulses); **6001** (industrial noise); **6002** (sound transmission through ceilings).

PLASTICS

5945 Preparation and Aromatization of Poly-1,3-cyclohexadiene. Polymerization of 1,3-cyclohexadiene to a low molecular weight polymer utilizing a Ziegler catalyst composed of tri-isobutylaluminum and $TiCl_4$. ***C. S. Marvel and Gordon***

E. Hartzell. *American Chemical Society, Journal,* v. 81, Jan. 20, 1959, p. 448-452.

5946 Big Molecules. The manufacturing methods and practical uses, as well as scientific discoveries in the chemistry of high polymers. ***Harry Melville.*** 180 pp. 1958. MacMillan, New York. (TP986.P6 M49b)

5947 The Relation Between the Molecular Weight and Intrinsic Viscosity of Polyacrylonitrile. *C. H. Bamford, A. D. Jenkins, R. Johnston, and E. F. T. White.* *Faraday Society, Transactions,* v. 55, Jan. 1959, p. 168-178.

5948 Gum Plastics. Emphasizes the applications of impact-polystyrene, ABS polymers, and impact PVC, and covers the general properties, chemistry, and fabrication of these compounds. An extensive treatment of rubber-modified plastic resins and their uses, describing their advantages in terms of product improvement, and showing how certain disadvantages of these materials can be overcome. Provides product designers, engineers, and fabricators in those industries which use or could use plastics with the first basic reference on gum plastics. ***M. Stafford Thompson.*** 193 pp. 1958. Reinhold, New York. (TP986.A2 T37g)

5949 Thermoplastic Polyesters From Bisphenols. Film-forming polyesters with good solubility in organic solvents, exceptionally high glass transition temperatures, and high melt viscosity are formed from bisphenols and aromatic and ethylenic dibasic acids. ***André Conix.*** *Industrial and Engineering Chemistry,* v. 51, Feb. 1959, p. 147-150.

5950 Linear Aromatic Polyesters of Carbonic Acid. High-melting, crystallizable polycarbonates are suitable for films, fibers, plastics, and coatings. ***Hermann Schnell.*** *Industrial and Engineering Chemistry,* v. 51, Feb. 1959, p. 157-160.

5951* Stability of the Cation Exchange Resins. Chemical stability to X-, β-, and γ-radiation of air-dry cation exchange resins in the H form has been studied in connection with the use of ion-exchange resins for absorption and separation of radioactive substance mixtures. ***V. A. Nikashina, A. Kh. Breger, M. M. Senyavin, and A. V. Gordievsky.*** *International Journal of Applied Radiation and Isotopes,* v. 4, nos. 3/4, Jan. 1959, p. 201-209.

5952 Dielectric Press "Welds" Vinyl-Covered Sandwich Panels. New technique uses dielectric heating to bond and emboss vinyl plastics. Developed for automotive trim, it shows promise for bonding and decorating a wide range of soft materials. ***R. H. Eshelman.*** *Iron Age,* v. 183, no. 6, Feb. 5, 1959, p. 83-85.

5953 Laminar Flow Degradation of Polyisobutene. A concentric cylinder viscometer was used to measure the degradation of polyisobutene in cetane at high shear rates under laminar flow conditions. ***Roger S. Porter and Julian F. Johnson.*** *Journal of Physical Chemistry,* v. 63, Feb. 1959, p. 202-205.

5954 Sonically Induced Heterolytic Cleavage of Polymethylsiloxane. Results of experiments showing that polymethylsiloxane, stressed by mechanical forces arising from cavitation of the fluid, degrades by a mechanism involving an ionic intermediate. ***J. R. Thomas and L. DeVries.*** *Journal of Physical Chemistry,* v. 63, Feb. 1959, p. 254-256.

5955* Copolymerization of *N*-Vinylurethane. L. Ghosez and G. Smets. *Journal of Polymer Science,* v. 35, Feb. 1959, p. 215-218.

5956* Calcium-Zinc Tetraethyl Complex as an Initiator for Vinyl Polymerization. *J. Furukawa, T. Tsuruta, S. Inoue, A. Kawasaki, and N. Kawabata.* *Journal of Polymer Science,* v. 35, Feb. 1959, p. 268-271.

5957* Vulcanization of High-Elastic Polymers. XXIII. The Kinetics of Vulcanization Reactions and the Physico-Mechanical Properties of Vulcanizates. The kinetics of increasing modulus and reciprocal swelling with time in thiuram vulcanization were investigated at different temperatures. Both processes proceed according to the first order and the rate constants are identical. (*In German.*) Zur Kenntnis der Vulkanisation hochelastischer Polymerisate. XXIII. Die chemische Kinetik der Vulkanisations-Reaktionen und die physikalisch-technischen Eigenschaften der Vulkanisate. ***Walter Scheele and Karl-Heinz Hillmer.*** *Kautschuk und Gummi,* v. 12, Jan. 1959, p. WT1-WT4.

5958* Makrolon, A Thermoplastic Polycarbonate Material. I. Manufacture and Properties. Makrolon is a high melting point thermoplastic bis-phenol polyester of carbonic acid. (*In German.*) Makrolon, ein thermoplastischer Kunststoff aus der Gruppe der Polykarbonate. I. Herstellung und Eigenschaften. ***W. Hechelhammer and G. Peilstöcker.*** *Kunststoffe,* v. 49, Jan. 1959, p. 3-8.

5959* Influence of Different Factors on the Hardening of Unsaturated Polyesters at Elevated Temperatures. Properties of reinforced polyester moldings are determined not only by the nature of the resin and that of the reinforcement, but also by the curing method. Curing experiments at elevated temperatures have shown that the optimum curing conditions depend upon the nature of the polyester resin. Experiments in which certain conditions such as temperature and time were varied, using polyester resins of different compositions, are described. (*In German.*) Einfluss verschiedener Faktoren auf die Härtung ungesättigter Polyester bei erhöhten Temperaturen. ***L. Turunen and B. Berndtsson.*** *Kunststoffe,* v. 49, Jan. 1959, p. 9-14.

5960 Polypropylene Resin. General properties of this new polyolefin plastic and suggestions of likely applications, including some data on blown and molded items for packaging. ***W. E. Gloor.*** *Modern Packaging,* v. 32, no. 6, Feb. 1959, p. 118 + 6 pages.

5961 Molding and Forming the New Polyolefins. Summarizes experience to date with the molding and forming of polypropylene and compares it with high-density polyethylene. Enthalpies, specific volumes, and shear-rate/shear-stress data are presented for most of the processing temperature range; their relationship to processing is discussed. ***Russell D. Hanns and John Y. Lomax.*** *Modern Plastics,* v. 36, no. 6, Feb. 1959, p. 111 + 7 pages.

5962 PTFE Bearing Materials. Chemically inert polytetrafluorethylene compounds have low coefficients of friction, can give long service if properly designed for load and speed. *Modern Plastics,* v. 36, no. 6, Feb. 1959, p. 123 + 4 pages.

5963* Influence of Temperature on Mechanical Properties of Some High Polymers Caused by Plasticizrs. (*In German.*) Über den Einfluss der Temperatur auf die durch Weichmacher verursachten mechanischen Eigenschaften einiger Hochpolymeren. ***K. Thinius and J. Schriber.*** *Plaste und Kautschuk,* v. 6, Jan. 1959, p. 6-11.

5964 High Impact P.V.C. as a Pipe Material. I. Properties and Characteristics. *S. Mottram.* *Plastics (London),* v. 24, Jan. 1959, p. 24-26.

5965 Polythene—Mechanism of Fracture. Study of the types of failure with discussion of the various test methods used. ***P. L. Clegg, S. Turner, and P. I. Vincent.*** *Plastics (London),* v. 24, Jan. 1959, p. 31-36.

5966* A New Approach to the Heating Cylinder Problem. A new type of injection machine heating chamber designed to overcome many of the deficiencies found in present heaters. Design is unique in that it is based on a study of defective molded articles. New heater helps to minimize all of the consumer-observed defects. ***A. Reynolds Morse.*** *Plastics Industry,* v. 17, Feb. 1959, p. 16-36.

5967 Heatsealing and High Frequency Welding of Plastics. I. *H. P. Zade.* *Plastics (London),* v. 24, Feb. 1959, p. 65-66.

5968 Some Experiments on the Flow Properties of Polythenes. Explanations are suggested for certain differences in the flow behavior of the various types of material, and for some apparent anomalies in the comparison of laboratory and operational results. ***R. W. Hogg.*** *Plastics (London),* v. 24, Feb. 1959, p. 69-72.

5969 Processing of Thermoplastic Materials. Reviews the engineering fundamentals on which the design of plastics processing equipment is based, and demonstrates the practical application of these fundamental concepts in the analysis of thermoplastics processing problems. The book is aimed at engineers, but does not require the reader to possess previous knowledge in plastics processing technology. ***Ernest C. Bernhardt, editor.*** 690 pp. 1959. Reinhold, New York. (TP986.A2 B45p)

5970* A Quick Test for Carbon Black Dispersion. Curves recorded on a simple microdensitometer can be analyzed statistically to give a precise measurement of carbon black dispersion in polyethylene. ***W. G. Best and H. F. Tomfohrde, III.*** *SPE Journal*, v. 15, Feb. 1959, p. 139-141.

5971* Degradation of Cellulose Acetate Films. Study on several commercial films showed that they varied widely in their stability. For highest stability, plasticizers containing an aliphatic ether linkage should be avoided and acid acceptors and anti-oxidants should be incorporated into the film formulation. ***William K. Wilson and B. W. Forshee.*** *SPE Journal*, v. 15, Feb. 1959, p. 146-156.

5972* Ground Radomes. The M.I.T., Lincoln Laboratory, radome design program. The radome types are categorized as uniform thin shell (reinforced plastics laminate, structural foam, and honeycomb sandwich) and space frame [metal-aluminum or steel, and dielectric (reinforced plastics)]. Pertinent characteristics of the polyurethane foams used are discussed. ***S. C. Nilo.*** *SPE Journal*, v. 15, Feb. 1959, p. 157 + 7 pages.

5973* Polyamine Resins for Finishing of Hydrophobic Fibers. Polyamines cross-linked by alkylation with polyhalides were selected to study the correlation between structure and antistatic performance. ***Emery I. Valko and Giuliana C. Tesoro.*** *Textile Research Journal*, v. 29, Jan. 1959, p. 21-31.

5974* Surface Friction and Dynamic Mechanical Properties of Polymers. Experiments on the lubricated sliding of metals on polymers over a range of speeds and temperatures. Results indicate a correlation between the frictional behavior of materials and their bulk mechanical properties. ***A. M. Bueche and D. G. Flom.*** *Wear*, v. 2, no. 3, Feb. 1959, p. 168-182.

5975* The Inhibiting Effect and the Structure of Inhibitors. II. The Inhibited Polymerization of Methylacrylate. A quantitative study has been made of the inhibiting action of 48 aromatic compounds on the polymerization of methylacrylate at 50 C. The inhibitors belong to three classes: hydrocarbons with a labile hydrogen atom, hydrocarbons with condensed and conjugated rings, and various benzene and nitrobenzene derivatives. (*In Russian.*) Ingibiruiushchii effekt i stroenie ingibitorov. II. Ingibirovannaia polimerizatsiia metilakrilata. ***Z. A. Sinitsyna and Kh. S. Bagdasar'ian.*** *Zhurnal Fizicheskoi Khimii*, v. 32, no. 12, Dec. 1958, p. 2663-2672.

See also: **5135** (tetrafluoroallene polymerization); **5212** (polymerization of acrylates); **5220** (copolymerization in coating compositions); **5251** (crosslinking processes and polymer properties); **5266** (wire coating).

POLLUTION AND WASTES

5976 Studies of Air Pollution Control by Southern California Edison Company. The realtive contribution of various pollutants found in the Los Angeles area is discussed. Processes designed to curtail the emission of oxides of sulfur and nitrogen are described, as well as some results of experiments at the Southern California Edison Company's El Segundo Steam Station. ***A. J. Haagen-Smit.*** *ASME, Transactions, Series A, Journal of Engineering for Power*, v. 81, no. 1, Jan. 1959, p. 1-6.

5977 Characteristics of Airborne Particles. Reviews some of the more useful parameters of particles and methods by which these can be measured. ***T. A. Rich.*** *ASME, Transactions, Series A, Journal of Engineering for Power*, v. 81, no. 1, Jan. 1959, p. 7-12.

5978 Plating Waste Disposal. Integrated System at Ronson Corporation. System is based on chemical treatment of the toxic compounds (cyanide, chromic acid, etc.) and their removal from the work and racks before rinsing. The treatment tank is an integral part of the finishing line and is constantly recirculated to a larger treatment solution reservoir. The chemicals consumed are replenished by additions at the reservoir tank and the precipitated salts removed by settling. ***Walter Mikos and Alfons Szkudlapski.*** *Metal Finishing*, v. 57, Feb. 1959, p. 61-64.

5979* Applications of Radiation in Sanitary Engineering. Discusses uses in such fields as hydraulics, water quality, insect control, food preservation, and air pollution. ***D. A. Pecsok, H. P. Kramer, and D. W. Moeller.*** *Public Health Reports*, v. 74, Feb. 1959, p. 119-126.

5980* Development of the Anaerobic Contact Process. I. Pilot-Plant Investigations and Economics. Study of the factors affecting the efficiency and economics of the anaerobic contact process as applied to various sewages and industrial wastes. A pilot plant test program was designed to determine whether a particular waste was amenable to anaerobic treatment and to determine the effect of a number of operating variables on the process efficiency and economics. ***George J. Schroepfer and Norman R. Ziemke.*** *Sewage and Industrial Wastes*, v. 31, Feb. 1959, p. 164-190.

5981* Treatment of Wastes From Tall Oil Refining. Pilot-plant studies revealed that a full-scale plant can be satisfactorily designed with a limited amount of waste sample and closely controlled laboratory studies, that tall oil refining wastes can be successfully treated, and that through the experimentation and study of interested operating personnel, optimum resutls can be obtained at minimum operating cost. ***B. W. Dickerson, W. T. Laffey, and R. O. McNeil.*** *Sewage and Industrial Wastes*, v. 31, Feb. 1959, p. 191-204.

See also: **4910** (economic utilization of sewage sludge); **5060** (purification of steel with smoke); **5090** (aqueous to solid radioactive wastes by calcination); **5101** (exhaust gas analysis).

RUBBER AND ELASTOMERS

5982 Cure of Polyurethane Elastomers With Peroxides. Peroxide cures can overcome many of the problems associated with polyurethane rubbers and permit a wider range of formulations. ***E. E. Gruber and O. C. Keplinger.*** *Industrial and Engineering Chemistry*, v. 51, Feb. 1959, p. 151-154.

5983 Improved Accelerators for Butyl Rubber. Higher Alkyl or Aryl Salts of Dithiocarbamic Acid. Accelerator modifications increase surface cure of butyl vulcanized in open steam. ***W. F. Fischer, R. F. Neu, and R. L. Zapp.*** *Industrial and Engineering Chemistry*, v. 51, Feb. 1959, p. 205-208.

5984* Dynamic Properties of Butyl Rubber and Their Applications. Butyl vulcanizates have been characterized as materials that combined dynamic softness with excellent shock absorption. ***R. L. Zapp.*** *Institution of the Rubber Industry, Proceedings*, v. 5, no. 6, Dec. 1958, p. 172-185.

5985* Vulcanisation of Dry Natural Rubber and Latex by Butyl Xanthogen Disulphide in the Absence of Free Sulphur. ***J. R. Dunn.*** *Institution of the Rubber Industry, Transactions*, v. 34, no. 6, Dec. 1958, p. 249-259.

5986* γ-Irradiation of Rubber and Styrene. Graft Polymer Formation. Extension of earlier work to quantitative aspects of energy absorption. ***D. T. Turner.*** *Journal of Polymer Science*, v. 35, Feb. 1959, p. 17-29.

5987* Wandering of Crosslinks in Rubber at High Temperatures. Some experiments which give further support to the

work on stress-relaxation of Tobolsky, both of a qualitative and quantitative nature. ***M. J. Voorn and J. J. Hermans.*** *Journal of Polymer Science*, v. 35, Feb. 1959, p. 113-118.

5988* Metal Dialkyldithiophosphates as Retarders of the Oxidative Degradation of Natural Rubber. Effect of dialkyldithiophosphates on the aging of natural rubber vulcanizates has now been compared with that of dialkyldithiocarbamates. ***J. R. Dunn and J. Scanlan.*** *Journal of Polymer Science*, v. 35, Feb. 1959, p. 267-268.

5989* The Future of Natural Rubber. The outlook for natural rubber has never been brighter. Production costs, the labor market, and technological advances—particularly chemical stimulation of the trees to increase yields—are working in its favor. ***John McGavack.*** *Rubber Age*, v. 84, no. 5, Feb. 1959, p. 789-794.

5990* How Hot Water Affects Elastomers. Indicates that curing silicone rubbers by gamma radiation makes them less susceptible to reversion. ***Robert Harrington.*** *Rubber Age*, v. 84, no. 5, Feb. 1959, p. 798-811.

5991 Flow Properties of Rubber/Black Batches. NR stock containing oil furnace structure blacks must be thoroughly milled in order to exploit their labile tendency and so obtain faster extrusion rates. In butyl stocks, excessive milling makes little difference to the oil furnace blacks studied. ***Z. Rigbi.*** *Rubber Journal and International Plastics*, v. 136, no. 5, Jan. 31, 1959, p. 157-160.

See also: **5380** (world rubber demands).

SPACE HEATING AND CONDITIONING

5992* Ventilation in the Graphic Arts. Properly designed hoods and general ventilation can protect the worker in graphic arts from industrial contaminants. ***Martin W. Jeremias.*** *Air Conditioning, Heating, and Ventilating*, v. 56, Feb. 1959, p. 73-84.

5993* Psychrometric Analysis Shows Limitations of All-Water Cooling for Multi-Room Building. Performance of all-water, fan-core systems fails to meet requirements of true air conditioning. ***Maurice J. Wilson.*** *Air Conditioning, Heating, and Ventilating*, v. 56, Feb. 1959, p. 89-93.

5994* Centrifugal Pump Troubles. Hydraulic and mechanical troubles in pumps are explained and remedies given. ***Igor J. Karassik and Roy Carter.*** *Air Conditioning, Heating, and Ventilating*, v. 56, Feb. 1959, p. 94-97.

5995 Air Hygiene for Hospitals. Tests were made to establish the efficiency of a hospital vacuum cleaner in arresting airborne and dustborne bacteria. ***Henry F. Allen.*** *American Medical Association, Journal*, v. 169, no. 6, Feb. 7, 1959, p. 553-559.

5996 High Velocity Air Conditioning Permits Building Economy. What is believed to be the first dual-duct high-velocity air conditioning system in the United Kingdom has been installed in the Newhall, Sheffield, offices of Brightside Heating and Engineering Company Limited. The installation was made for the purpose of developing and proving the system—in particular of suppressing the noise of the high-speed airflow—before making it commercially available. *Engineering*, v. 187, Jan. 30, 1959, p. 158-159.

5997* Selling Electronic Air Cleaners in the New Home Market. Operating principle of electronic air cleaners is simply presented. ***P. J. Zilles.*** *Heating & Air Conditioning Contractor*, v. 50, no. 5, Feb. 1959, p. 56-59.

5998 Noise Characteristics for the Boeing 707. Boeing guaranteed the delivery of a suppressor providing 6 db reduction of noise at the angle of maximum noise, with an ultimate design objective of 10 db. The objective of the company was to make the Model 707-120 jet transport equivalent in noise level to the current high gross weight propeller airplane. ***Robert M. Gibbs and Harry H. Howell.*** *Noise Control*, v. 5, Jan. 1959, p. 13 + 5 pages.

5999 Noise Suppressors for Jet Engines. Industry is well aware of the noise problem and is taking steps to alleviate it in the early aircraft design stages, hoping that future aircraft may present no serious noise problems. ***Edmund E. Callaghan.*** *Noise Control*, v. 5, Jan. 1959, p. 18 + 6 pages.

6000 Airports and Jet Noise. ***Laymon N. Miller, Leo L. Beranek, and Karl D. Kryter.*** *Noise Control*, v. 5, Jan. 1959, p. 24-31.

6001 Current Research in Industrial Noise. A physician's approach to noise measurement, noise exposure control, auditory effects of noise exposure, and nonauditory effects of noise exposure. ***Aram Glorig.*** *Noise Control*, v. 5, Jan. 1959, p. 32 + 4 pages.

6002 Sound Transmission Through Suspended Ceilings Over Partitions. Formulation of problem; experimental procedure; effect of ceiling characteristics; effect of plenum characteristics. ***Richard N. Hamme.*** *Noise Control*, v. 5, Jan. 1959, p. 64 + 6 pages.

6003* Plants Can Be Air Conditioned—Economically. Cool workers bring companies "payroll dividends". To estimate roughly how much should be spent for plant air conditioning the gross annual wage for the plant should be divided by four. ***Charles V. Fenn.*** *Plant*, v. 19, Feb. 1959, p. 27-30.

See also: **5060** (purification of steel with smoke).

TEXTILES, FIBERS, LEATHER, AND PAPER

6004* The Use of Silvicides in Forest Management. ***S. F. Potts.*** *Agricultural Chemicals*, v. 14, Feb. 1959, p. 60 + 3 pages.

6005 The Cotton Industry in a World Economy. A record of the Venice Conference whose purpose was to take stock of the present state of affairs and to forecast future trends. Main theme is economics. ***Mario Ludwig, editor.*** 286 pp. 1958. The International Federation of Cotton and Allied Textile Industries, Manchester 2, England. (TS1550 In8c)

6006* The Consumer's Attitude Toward Lumber in Exterior Walls of Houses. ***Joseph Zaremba.*** *Journal of Forestry*, v. 57, Feb. 1959, p. 90-94.

6007* Georgia's Seed Certification Program. The Georgia Standards provide for 3 classes of certification. Production from seed-producing areas and from individually selected plus trees will qualify for Class III. Seed from seed orchards and from elite trees will qualify for Class I or Class II, depending upon completion of progeny tests and adequecy of isolation strips. *Journal of Forestry*, v. 57, Feb. 1959, p. 125-126.

6008 The Phenolic Constituents of *Prunus domestica*. I. The Quantitative Analysis of Phenolic Constituents. ***T. Swain and W. E. Hillis.*** *Journal of the Science of Food and Agriculture*, v. 10, Jan. 1959, p. 63-68.

6009* A Contribution to the Study of the Culture and Cellulose Synthesis of Acetobacter Xylinum (Brown) Holland. Satisfactory growth and a considerable cellulose synthesis were obtained on H_2O 1000 ml, KH_2PO_4 0.7 g., Na_2HPO_4 0.3 g., $MgSO_4$ 0.5 g., $CaCl_2$ 0.1 g., NH_4NO_3 1.0 g., $FeCl_3$ (10%) 1 drop, Hoagland A-Z solution 1 ml, ethanol 10 ml, glucose 40 g., p-aminobenzoic acid 10 to 100 γ. *A. xylinum* can be used as test organism for the quantitative determination of p-aminobenzoic acids. The dry weight increases from 0 to 0.5 γ p-aminobenzoic acid/ml of culture solution is proportional to the concentration of the effective substance. (*In German.*) Zur Kultur und Cellulosesynthese von Acetobacter xylinum (Brown) Holland. ***Hubert Ziegler and Josef Weigl.*** *Naturwissenschaften*, v. 46, no. 1, Jan. 1959, p. 20.

6010* Dimensional Stability of Paper. Summaries of three papers presented at a conference at the U. S. Forest Products Laboratory, Madison, Wis., on dimensional stability of wood and paper. ***John L. Morton and Norbert M. Bikales.*** *Paper Trade Journal*, v. 143, Feb. 16, 1959, p. 43.

6011 What's New About the New Papers. New treatments add moisture resistance, stretchability, and heat and flame resistance to conventional papers. New fibers add strength and dimensional ability. Describes what is available and what is to come. ***Annesta R. Gardner.*** *Product Engineering*, v. 30, no. 7, Feb. 16, 1959, p. 50-53.

6012* China Plans Impressive Expansion. A plan is made for the building of paper mills with a total annual capacity of 1.5 million tons; to reduce the time for designing a big mill from 20 to from 14 to 7 months. Plans for doubling the forest area within the next 10 years. Some important mills. Machinery design and manufacture. ***Robert Westgate.*** *Pulp and Paper Magazine of Canada*, v. 60, Jan. 1959, p. 86-90.

6013* The Effects of Some Genetic and Environmental Factors on Wood Quality in Poplar. ***R. W. Kennedy and J. H. G. Smith.*** *Pulp and Paper Magazine of Canada*, v. 60, Feb. 1959, p. T35-T36.

6014* Forest Industries Set Tree Planting Record. American Forest Products Industries say private owners this year are planting 362,325,000 trees, mostly in the South. *Southern Lumberman*, v. 198, Feb. 15, 1959, p. 23.

6015* Wood Stabilization Research Studied. A conference at Madison, Wisconsin, Forest Products Laboratory, was held on January 21-23, 1959. Recommendations concerning the necessity for more information concerning wood-moisture relationships, for additional work in connection with chemical and dimensional stabilization of wood were adopted and other problems were tackled such as the chemical nature of wood, the better use of existing knowledge, paper swelling and shrinking, and the need for expanded wood. *Southern Lumberman*, v. 198, Feb. 15, 1959, p. 28-30.

6016* Lignin Sulphonic Acids as Mould Nutrients. By extended cultivation of the mold mixture on lignin sulphonic acid in the presence of inorganic nutrients, growth efficiency was considerably improved. No metabolic products, with the exception of oxalic acid, have been identified. Growth was found to be dependent on the lignin sulphonate concentration but independent of the molecular size of the lignin sulphonate fractions. A few factors of the probable reaction mechanism and the causes of the persistance of lignin sulphonates in rivers are discussed. ***Theodor N. Kleinert and Carlton S. Joyce.*** *Svensk Papperstidning*, v. 62, no. 2, Jan. 31, 1959, p. 37-44.

6017* Dimensional Stabilization of Wood by Thermal Reactions and Formaldehyde Cross-Linking. ***Alfred J. Stamm.*** *Tappi*, v. 42, Jan. 1959, p. 39-44.

6018* Dimensional Stabilization of Paper by Catalyzed Heat Treatment and Cross-Linking With Formaldehyde. ***Alfred J. Stamm.*** *Tappi*, v. 42, Jan. 1959, p. 44-50.

6019 Paper Coating Pigments. A revision of an earlier monograph which brings the subject matter up to date, covering such topics as barium sulphate, calcium carbonate, calcium sulphite, clay, colorants for aqueous mineral coatings, diatomaceous silica, and others. *TAPPI Monograph Series No. 20*, 1958, 235 pp. (TS1080 T22tm Vis.)

See also: **5973** (textile finishes).

WELDING AND JOINING

6020 Thin Doublers for Fatigue-Resistant Aluminum-Alloy Structures. A description of how high bending stresses can be reduced by thin doublers of titanium or stainless steel engaging an extra row of rivets outside the main splice. While this introduces a problem in bimetallic corrosion, the gains in fatigue life and fail-safe features more than offset the extra work required for corrosion prevention. ***C. R. Smith.*** *Aero/Space Engineering*, v. 18, Feb. 1959, p. 40 + 3 pages.

6021* Thermit Welding and Its Applications. Thermit, a balanced mixture of iron oxide and Al, when ignited, provides the high temperature needed for welding by fusion and by heat and pressure, as well as for other uses. ***R. W. Vogt.*** *Australasian Engineer*, 1959, Jan. 7, p. 67.

6022 Effect of Columbium on the Structure of Welds in Austenitic 18-8 Steel. Study of effect of 0.7% to 3.05% Columbium on structure and mechanical properties of austenitic 18-8 welds, as-welded; after quenching; after stabilizing anneal; and after 1000 hours of holding at 650 C (1200 F). ***G. G. Mukhin and N. Yu. Pal'chuk.*** *Henry Brutcher Translation No.* 4412, 18 pp. (From *Avtomaticheskaya Svarka*, v. 10, no. 2, 1957, p. 1-10.) Henry Brutcher, Altadena, Calif.

6023 Stability of Electroslag Welding as Depending on Properties of Flux. Difference between electroslag welding and conventional submerged arc welding. ***Yu. N. Gotal'skii.*** *Henry Brutcher Translation No.* 4426, 10 pp. (From *Svarochnoe Proizvodstvo*, 1957, no. 3, p. 1-3.) Henry Brutcher, Altadena, Calif.

6024 Success—Welding Method for Type 347. Close control of technique, temperature and materials leads to successful technique for welding test loop made from heavy sections of stainless steel. ***A. M. Bain, A. H. Clark, and M. J. Lavigne.*** *Canadian Metalworking*, v. 22, Feb. 1959, p. 28 + 5 pages.

6025 The Fatigue Strength of Weld Metal. ***O. Eiro.*** *Engineers' Digest*, v. 20, Jan. 1959, p. 45-47. (Translated from *Acta Polytechnica Scandinavica, Mechanical Engineering Series*, no. 3, 1958, 26 pp. 7 illustrations.)

6026 Rubber Bonds Flexible Insert. Rubber plays a dual role in replacing springs in a jaw insert providing flexibility and bonding the jaw end to the base. *Iron Age*, v. 183, no. 6, Feb. 5, 1959, p. 93.

6027 Progress Report on Ultrasonic Welding. Describes newest equipment made by the Sonobond Corporation. *Machinery (New York)*, v. 65, no. 6, Feb. 1959, p. 122-123.

6028 What the Designer Should Know About Production. V. Resistance Welding. Presents spot, projection, seam and flash-butt welding, giving diagrams of each. ***Joseph J. Panik.*** *Machinery, (New York)*, v. 65, no. 6, Feb. 1959, p. 136-146.

6029 Welding and Metal Forming in Russia. Electroslag welding is used to fabricate large parts from components while friction welding is claimed to be much more efficient than flash welding. ***Arthur B. Tesmen.*** *Metal Progress*, v. 75, no. 1, Jan. 1959, p. 79-83.

6030 You Can Do More With CO_2 Welding. Improvements in welding heads, and refinements in shielding techniques add to the versatility of the process. With a reactor in the circuit, good overhead and vertical-up welds are possible. In addition to its shielding function, CO_2 gas raises the temperature of molten weld metal and deepens penetration. *Metal Progress*, v. 75, no. 2, Feb. 1959, p. 110 + 8 pages.

6031* Riveting. II. A study of the riveting operation: forming the closing head percussion or compression riveting, main defects, suppression of abrupt section variations, of torsions, etc. Special cases. (*In French.*) Le rivetage. II. ***Paul Penel.*** *Revue de l'Aluminium*, v. 35, no. 260, Dec. 1958, p. 1237-1248.

6032 Inert-Gas Metal-Arc Welding Aluminium Using Fine Wire Electrodes. British adaptations of fine wire feeding equipment are described and results of welds made with .030 and .020 in. diameter wires are given. ***J. E. Tomlinson and A. J. King.*** *Welding and Metal Fabrication*, v. 27, Feb. 1959, p. 42-50.

6033 The Colmonoy Sprayweld Process and Its Applications. ***W. J. Burling Smith.*** *Welding and Metal Fabrication*, v. 27, Feb. 1959, p. 54-60.

6034 Some Facts About Iron Powder Electrodes. The principle of controlling hydrogen in the weld metal, previously applied to basic electrodes only, has now been extended to iron powder electrodes based on rutile. As a result, electrodes are now available that combine the excellent ductility and resistance to fissuring of basic electrodes with the attractive welding features of ordinary rutile iron powder electrodes. ***A. B. Field-***

house. *Welding and Metal Fabrication*, v. 27, Feb. 1959, p. 61-70.

6035 Fabrication of Welded Highway Girders. Weld size, jigs and assembly fixtures, positioning methods and mechanization of process used are some of the cost factors considered. ***R. A. Wilson.*** *Welding Journal*, v. 38, Feb. 1959, p. 111-117.

6036 Sterling-Plus-Lithium Alloy Selected for Brazing B-58 Stainless-Steel Sandwich Panels. ***A. A. Lanzara and A. M. Setapen.*** *Welding Journal*, v. 38, Feb. 1959, p. 118-124.

6037 Automatic Welding Techniques Speed Erection of Reactor Vessels. Field fabrication of containment vessels aided by developing special welding positioners and by perfecting techniques for handling and erecting large preassembled sections. ***W. A. Davis.*** *Welding Journal*, v. 38, Feb. 1959, p. 125-128.

6038 Training of Inert-Gas Welders at an Atomic Power Plant. Three weeks of specialized training insures the welders' higher skill in performing the work under variable conditions of production. ***G. J. Green nad D. E. Callahan.*** *Welding Journal*, v. 38, Feb. 1959, p. 129-131.

6039 Electro-Slag Method of Welding Metals of Large Thickness. This is a highly productive method developed in the Soviet Union. ***M. M. Barash, W. B. Heginbotham, and P. B. L. Oxley.*** *Welding Journal*, v. 38, Feb. 1959, p. 132-134.

6040 Semiautomatic Submerged-Arc Welding Speeds Fabrication of Large Beams. ***E. E. Goehringer.*** *Welding Journal*, v. 38, Feb. 1959, p. 138-140.

6041 Effect of Backup Variables on Series Spot Welding of Steel. Investigation covers the study of the effects of backup bar and stool combinations of varying electrical conductivity upon the shunting current and tensile-shear strength of spot-welded joints. ***E. F. Nippes, W. F. Savage, and K. E. Dorschu.*** *Welding Journal*, v. 38, Feb. 1959, p. 49s-56s.

6042 Properties Affecting Suitability of 9 Percent Nickel Steel for Low-Temperature Service. Low-carbon 9% nickel steel in the double-normalized and stress-relieved condition retains considerable notch toughness at temperatures down to that of liquid nitrogen. ***T. N. Armstrong, J. H. Gross, and R. E. Brien.*** *Welding Journal*, v. 38, Feb. 1959, p. 57s-70s.

6043 Development of Titanium-Clad Steel Using a Vacuum-Brazing Process. Investigation includes such brazing parameters as filler-metal composition, brazing cycle, degree of vacuum, and surface-preparation methods. Also, procedures and joint designs are covered. ***D. Canonico and H. Schwartzbart.*** *Welding Journal*, v. 38, Feb. 1959, p. 71s-77s.

6044 Methods for End Capping Zirconium-Clad Reactor Fuel Pins. Development program indicates that best seal is obtained by using a fuel pin in which the core is recessed to receive an end-cap insert that is attached and sealed by arc welding. ***J. J. Vagi, R. L. Koppenhofer, and D. C. Martin.*** *Welding Journal*, v. 38, Feb. 1959, p. 78s-84s.

6045 Brazing by the Diffusion-Controlled Formation of a Liquid Intermediate Phase. Successful brazes can be made at temperatures considerably below the melting point of any of the component parts of an assembly if the materials are such that the pertinent equilibrium diagram contains a low-temperature liquid phase. ***James F. Lynch, Lester Feinstein, and Robert A. Huggins.*** *Welding Journal*, v. 38, Feb. 1959, p. 85s-89s.

See also: **5231** (measuring adhesion of wood coatings); **5812** (weld inspection); **5813** (weld inspection); **5817** (inspection of brazed joints); **5967** (heatsealing and welding plastics).

MISCELLANEOUS

6046 Man-Machine Integration in Space Vehicles. States that "man's requirements must be placed on an equal level with those of the machine—and particularly in the spaceship if we are going to be successful in this new endeavor." ***George W. Hoover.*** *Aero/Space Engineering*, v. 18, Feb. 1959, p. 54-58.

6047* Careers in Research. The main avenues through which a young man can enter the research and development sides of British aviation are described. ***M. J. Hardy.*** *Aeronautics*, v. 39, no. 6, Feb. 1959, p. 42-44.

6048* A Partial Solution of General Ideal Plasticity Equations in Cylindrical Coordinates. (*In Russian.*) Ob odnom chastnom reshenii obshchikh uravenii teorii ideal'noĭ plastichnosti v tsilindricheskikh koordinatakh. ***D. D. Ivlev.*** *Akademiia Nauk SSSR, Doklady*, v. 123, no. 6, Dec. 21, 1958, p. 988-990.

6049* Adaptation-Level vs. the Relativity of Judgment. Difficulty in distinguishing between sensory adaptation and judgmental relativity is explained and the adaption-level theory is criticized. ***S. S. Stevens.*** *American Journal of Psychology*, v. 71, no. 4, Dec. 1958, p. 633-646.

6050* The Effect of Signal-Rate on Performance in Visual Monitoring. The percentage of pointer-signals detected declined in the course of the watch, depending upon the signal-rate, with lower rates producing greater declines. It was also found that stable individual differences exist in ability to sustain performance. ***Herbert M. Jenkins.*** *American Journal of Psychology*, v. 71, no. 4, Dec. 1958, p. 647-661.

6051* Multiple-Choice Decision-Behavior. This study showed that the relative frequency of the response to the most frequently presented stimulus-event was found to be a function of the number of choices. ***R. Allen Gardner.*** *American Journal of Psychology*, v. 71, no. 4, Dec. 1958, p. 710-717.

6052* Generalization Among Meaningful Relations in Problem-Solving. This experiment demonstrates the occurrence of stimulus-generalization among meaningful stimulus-patterns. ***Wilbert S. Ray.*** *American Journal of Psychology*, v. 71, no. 4, Dec. 1958, p. 737-741.

6053* Training in Confidence-Judgments. An experiment is described in which the discrepancy between confidence and performance was measured by having the subject report his judgments in terms of expected percentages. ***Pauline Austin Adams and Joe K. Adams.*** *American Journal of Psychology*, v. 71, no. 4, Dec. 1958, p. 747-751.

6054* Reconciling Conflicting Results Derived From Experimental and Survey Studies of Attitude Change. Discrepancies in results of the two methods are due to different definitions of the communication situation, and differences in type of communicator, audience, and kind of issue utilized. ***Carl I. Hovland.*** *American Psychologist*, v. 14, Jan. 1959, p. 8-17.

6055* Rats, Man, and the Welfare State. Compares physiological differences between wild and domesticated rats and shows parallel to uncivilized and civilized man and his diseases. ***Curt P. Richter.*** *American Psychologist*, v. 14, Jan. 1959, p. 18-28.

6056* Significance Tests in Parallel and in Series. The statistician could in some cases use a harmonic mean or weighted harmonic mean of the tail-area probabilities arising from various tests, all on the same evidence (tests in "parallel"). ***I. J. Good.*** *American Statistical Association, Journal*, v. 53, no. 284, Dec. 1958, p. 799-813.

6057* Curtailed Sampling for Variables. ***Norman R. Garner.*** *American Statistical Association, Journal*, v. 58, no. 284, Dec. 1958, p. 862-867.

6058* Origin and Development of the Chinese Abacus. An authenticated history of this efficient device. ***Shu-T'ien Li.*** *Association for Computing Machinery, Journal*, v. 6, no. 1, Jan. 1959, p. 102-110.

6059* Keeping Radiation Exposure Records. As the nuclear industry expands, more organizations will have to set up health checks and ensure that no one is exposed to radiation above the recommended limit. At the Clarendon Laboratory a rigid system of preventive measures is established, and special record sheets have been developed to simplify the work. ***D. F. Shaw.*** *Atomic World*, v. 9, Nov. 1958, p. 386-387.

6060 Let's Make That Atmosphere Furnace Safe. Paramount considerations must include condition and location of equipment, personnel protective equipment, and atmosphere and furnace handling techniques. ***M. A. Cocca.*** *Ceramic Industry*, v. 72, Feb. 1959, p. 74 + 4 pages.

6061 Chemistry and the Railways. The various chemical factors in the railroad industry such as lubricants, paints, and structural materials' behavior necessitate the services of a chemical staff and the maintenance of test laboratories. ***F. Fancutt.*** *Chemistry & Industry*, 1959, no. 6, Feb. 7, p. 172-180.

6062 Inventing and Its Place in Modern Industry. First of a series of articles on the mental process of inventing and methodical inventing procedure. ***Hyman Olken.*** *Electromechanical Design*, v. 3, no. 2, Feb. 1959, p. 34.

6063 Japan Acts to Slow Licensing. Research subsidies aim at reducing dependence of electronics industry on U. S. licenses, now at high mark. Capital tie-ins also substantial. *Electronics*, v. 32, no. 7, Feb. 13, 1959, p. 38-39.

6064 "Mr. Chairman and Gentlemen". In a light vein, trends in the conduct of meetings and, in particular, the foibles of some speakers are discussed. ***"Jacques".*** *Foundry Trade Journal*, v. 106, Jan. 22, 1959, p. 99-100.

6065 A Subjective Merit Review System. This paper highlights some of the disadvantages of the present objective systems, and offers instead a system whereby a supervisor is given great latitude in reviewing his subordinates. ***Daniel J. Strauss.*** *IRE Transactions on Engineering Management*, v. EM-5, no. 4, Dec. 1958, p. 141-143.

6066 Logic and Illogic in Engineering and Management. Methods of the engineering supervisor or manager for filtering out emotionally inspired illogic in order to reach clear decisions are presented. These range from defining the basic problem to making a balance sheet and weighing both tangible and intangible factors. ***A. L. Stanly.*** *IRE Transactions on Engineering Management*, v. EM-5, no. 4, Dec. 1958, p. 144-151 (TK1 In6.6em Vis.)

6067 Designing for Safety. I. Shows that safety in design is a matter of forethought and imagination on the part of the design engineer. *Industrial and Engineering Chemistry*, v. 51, Feb. 1959, p. 52A-56A.

6068 What Is a Measurement? A Hidden Complex of Circumstances Operates on Every Recorded Observation. A good description of a method of measurement includes a careful statement of the materials, the range of magnitudes, and the circumstances under which the method will give satisfactory results. ***W. J. Youden.*** *Industrial and Engineering Chemistry*, v. 51, Feb. 1959, p. 81A-82A.

6069 Explosive Hazard of Aluminum-Liquid Oxygen Mixtures. *Calvin M. Austin, Charles S. Rohrer, and Ralph L. Seifert.* *Journal of Chemical Education*, v. 36, Feb. 1959, p. 54-57.

6070* Effects on Verbal Learning of Anxiety, Reassurance, and Meaningfulness of Material. There was a significant interaction between test anxiety (high and low) and the kind of instructions (reassurance and standard) administered. Reassurance instructions were relatively facilitative for high test anxiety subjects and relatively detrimental for low test anxiety subjects. ***Irwin G. Sarason.*** *Journal of Experimental Psychology*, v. 56, no. 6, Dec. 1958, p. 472-477.

6071* Information and Autokinetic Movement. This experiment examines the hypothesis that autokinetic movement occurs if the visual world is highly redundant and does not occur if the visual world is full of information. If this experiment is a fair test, the hypothesis is wrong. ***Ward Edwards.*** *Journal of Experimental Psychology*, v. 57, no. 2, Feb. 1959, p. 89-90.

6072* Safety Performance Measurement. Explores the problem of the measurement of safety performance. ***Thomas H. Rockwell.*** *Journal of Industrial Engineering*, v. 10, no. 1, Jan.-Feb. 1959, p. 12-16.

6073* Statistical Scheduling of a Highly Mechanized Production Facility. As production facilities have become more highly mechanized, a situation arises where production is not only a result of working hours but also of machine performance during those hours. The introduction of this additional factor makes time scheduling alone inadequate. Production scheduling must now be based on machine performance as well as time. ***William F. Pounds and Erwin P. Kraai.*** *Journal of Industrial Engineering*, v. 10, no. 1, Jan.-Feb. 1959, p. 17-20.

6074* The Engineer and Resistance to Change. Resistance to change presents a formidable problem not only in getting ideas adopted, but in obtaining the cooperation of persons affected by new procedures after adoption. Specific methods of minimizing resistance to change are given in detail. ***Edward V. Krick.*** *Journal of Industrial Engineering*, v. 10, no. 1, Jan.-Feb. 1959, p. 21-24.

6075* Using Work Sampling to Study the Activities of Research Workers. *John S. Herrick.* *Journal of Industrial Engineering*, v. 10, no. 1, Jan.-Feb. 1959, p. 60-63.

6076* Rupture of Round Bars by Tension. A mathematical analysis. ***T. Y. Thomas.*** *Journal of Mathematics and Mechanics*, v. 8, no. 1, Jan. 1959, p. 1-25.

6077* Convergence of Solutions of Parabolic Equations to a Steady State. *Avner Friedman.* *Journal of Mathematics and Mechanics*, v. 8, no. 1, Jan. 1959, p. 57-76.

6078* Graphs and Vector Spaces. The problem of finding a corresponding graph when a vector space is specified. Hitherto only exhaustive methods have been employed; this paper presents a direct algebraic solution. ***Roderick Gould.*** *Journal of Mathematics and Physics*, v. 37, no. 3, Oct. 1958, p. 193-214.

6079* Psychological Aspects of Laboratory Work. V. (Sec. I) Some Wider Human Problems. Deals with the effects age and environment have on work performance and the development of recommended work standards. ***Roland Harper.*** *Laboratory Practice*, v. 8, Feb. 1959, p. 51-54.

6080* Panic and Phobia—A Possible Method of Treatment. *Nicolas Malleson.* *Lancet*, v. 1, Jan. 31, 1959, p. 225-227.

6081 The MMH Materials Handling Manual. Considers automation applications in various industries, in warehousing, and shipping. ***V. H. Laughner, editor.*** v. III. 358 pp. 1958. Boston Publishing Co., Inc., Boston. (TJ1350 M72m)

6082 Aspects of Russian Engineering Industry. Impressions of a visitor to a plant manufacturing steam and water turbines. *Machinery (London)*, v. 93, Dec. 3, 1958, p. 1272-1286.

6083 Management's Stake in Research. Seeks to define the role of research in today's industrial complex. Discusses possible solutions to problems such as whether to buy growth or build it through research, whether to establish a full research department or "farm out" specific projects, how to measure research performance, and how to finance research and its results. ***Maurice Holland.*** 143 pp. 1958. Harper & Brothers, New York. (HD20 H71m)

6084* A Note on Summation Formulas of Powers of Roots. *Daniel C. Fielder.* *Mathematical Tables and Other Aids to Computation*, v. 12, no. 63, July 1958, p. 194-198.

6085* Mathematics in the Engineering Curriculum. An attempt to determine the major current curriculum patterns of engineering mathematics. ***Joseph Seidlin and C. N. Shuster.*** *Mathematics Magazine*, v. 32, no. 3, Jan.-Feb. 1959, p. 137-149.

6086* Impact Protection With Foam Plastics. Gives the procedure used to select a low-density cellular plastic of the right dimensions and mechanical properties to protect the head in impact. ***E. R. Dye and M. D. Smith.*** *Mechanical Engineering*, v. 80, Dec. 1958, p. 65-67.

6087* Trains Without Tracks. Concludes that the integration of the offroad train concept into logistical planning for the future Army should not await standardization and quantity

production of equipment, but should begin now at all levels. ***Frank B. Case.*** *Military Review*, v. 38, no. 12, Mar. 1959, p. 42-50.

6088 Mind and Matter. In this book, a distinguished scientist reminds his readers of some of the paradoxes in the relationship between mind and matter, and offers suggestions towards a solution of the problem. The subjects discussed include consciousness, understanding, the principle of objectivation, the oneness of mind and science and religion. ***Erwin Schrödinger.*** 104 pp. 1958. Cambridge University Press, London. (BF161 Sch76m)

6089* Human Performance Criteria in Man-Machine Systems. ***H. L. Williams.*** *Missile Design and Development*, v. 5, Feb. 1959, p. 28-30.

6090 Models of Man. This book offers a consistent body of theories of the rational and nonrational aspects of human behavior in a social setting and contains sixteen essays of interest to a wide range of specialists such as political scientists, social psychologists, sociologists, statisticians, logicians, and learning theorists. The essays can be grouped under the following general titles: causation and influence relations; social processes; motivation: inducement and contributions; rationality and administrative decision making. The language used, on utilitarian grounds, was mathematics. ***Herbert A. Simon.*** 287 pp. 1957. John Wiley & Sons, New York. (H33 Si53m)

6091 The Process of Mass Acceptance. Twenty years of basic research summarized by sociologists at Iowa State throw revealing light on the behavior pattern of consumers faced with use or rejection of a new packaging concept. *Modern Packaging*, v. 32, no. 6, Feb. 1959, p. 75 + 5 pages.

6092 Graphitization and Plastic Deformation of Diamond. ***M. Seal.*** *Nature*, v. 182, Nov. 8, 1958, p. 1264-1267.

6093* Race and Intelligence. For reasons explained in the article, the question whether there are genuine racial differences in intelligence cannot be answered. But there is certainly no justification for assuming that any one race can be wholly categorized as inferior to others. ***P. E. Vernon.*** *New Scientist*, v. 5, Jan. 22, 1959, p. 170-171.

6094 Man in Space. A physiologist's view of man's travel in unfriendly environment. ***F. A. Hitchcock.*** *News in Engineering at Ohio State University*, v. 30, no. 4, Nov. 1958, p. 18-24.

6095 Numerical Mathematical Analysis. Objective is to set forth in a systematic manner and as clearly as possible the most important principles, methods, and processes used for obtaining numerical results; and also methods and means for estimating the accuracy of such results. ***James B. Scarborough.*** 4th Ed. 576 pp. 1958. Johns Hopkins Press, Baltimore. (QA300 Sc72n4)

6096* New Geometrical Methods of the Theory of Physical Fields. Relativistic theory of the electromagnetic field in uniformly moving dielectric. A model example of classical bilocal theory of physical fields. Differential structure of classical fields in generalized metrical space. ***J. I. Horváth.*** *Nuovo Cimento*, v. 9, ser. 10; Supplemento No. 2, 1958, p. 444-446.

6097* Multiple Scattering by a Random Stack of Dielectric Slabs. ***I. Kay and R. A. Silverman.*** *Nuovo Cimento*, v. 9, ser. 10; Supplemento No. 2, 1958, p. 626-645.

6098* A Monte-Carlo Method to Calculate Multiple Phase Space Integrals. I.-II. ***F. Cerulus and R. Hagedorn.*** *Nuovo Cimento*, v. 9, ser. 10; Supplemento No. 2, 1958, p. 646-677.

6099* Traffic Dynamics: Analysis of Stability in Car Following. A theoretical investigation was made of several models of car following, such as relative velocity and constant spacing control. It was shown experimentally that an approximate description of the way in which a car follows a leader is given by relative velocity control in which the acceleration at time t of the following car is proportional to the relative velocity of the two cars at a retarded time t-Δ. The asymptotic stability of a chain of vehicles when disturbed by a fluctuation in the motion of the lead car was also investigated. ***Robert Herman, Elliott W. Montroll, Renfrey B. Potts, and Richard W. Rothery.*** *Operations Research*, v. 7, no. 1, Jan.-Feb. 1959, p. 86-106.

6100 Identification of Signal Lights. I. Blue, Green, White, and Purple. One hundred observers identified by name fifty test colors. Large individual differences in color naming were found. ***Rita M. Halsey.*** *Optical Society of America, Journal*, v. 49, Jan. 1959, p. 45-55.

6101* The Teaching Machine. The character and applications of an electrical device for training operators of keyboard machines. ***Gordon Pask.*** *Overseas Engineer*, v. 32, Feb. 1959, p. 231-232.

6102* Safety Hazards in the Recovery of Pulping Chemicals. Relates industrial experiences with some typical hazards. ***W. Stengel.*** *Paper Trade Journal*, v. 142, Dec. 1, 1958, p. 32-33.

6103 Perception and Communication. Reviews recent experimental work within the field broadly known as 'attention', with the emphasis on hearing rather than vision. Results are discussed in the theoretical framework of information theory and related to experimental data from animals. Problems usually handled by neo-Pavlovian theory are considered and while some knowledge of current psychological theorizing—particularly that of Hull and Skinner—is desirable, it is not assumed that the reader is familiar with information theory or has any mathematical knowledge at all. ***D. E. Broadbent.*** 338 pp. 1958. Pergamon Press, New York. (BF38 B78p)

6104 Planning of Experiments. Discusses the ideas underlying modern work on the statistical aspects of experimental design. ***D. R. Cox.*** 308 pp. 1958. John Wiley & Sons, New York. (Q175 C83p)

6105 Foreign Patents—Nuisances or Nuggets? Review of the pitfalls and potentials of international patent protection. ***Worth Wade.*** *Product Engineering*, v. 29, no. 51, Dec. 15, 1958, p. 27-29.

6106 The Role of Science and Technology in Modern War. The author occupies an important position in the Soviet development of weapons. ***G. I. Pokrovskii.*** *Rand Corporation, Translation T-79*, Feb. 5, 1958, 37 pp. (From "Lectures of the All-Union Society for the Dissemination of Political and Scientific Knowledge", Moscow, 1957.) Rand Corporation, Santa Monica, Calif.

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6108 Man Machine Relationships. Concerns the concept of man-machine relationships and the light which this concept sheds on the validity of the endeavors to design machines to simulate the behavior of the human brain. ***Mortimer Taube.*** *Research & Engineering*, v. 5, Jan.-Feb. 1959, p. 18-22.

6109* The Origin of Life. A brief review of current theories. ***G. Shaw.*** *Royal Australian Chemical Institute, Proceedings*, v. 25, Oct. 1958, p. 505-506.

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6113* How to Improve Safety in Foundries. Statistical survey of accidents and condition of health. Technical precautions, training of employees of all degrees and means of personal protection. (*In Czech.*) Cesty k zvýšení bezpečnosti práce ve slévárnách. ***Jiří Sirokich.*** *Slévárenství*, v. 6, no. 12, Dec. 1958, p. 379-384.